

from cars and towards walking, cycling and public transport. In total 15% of spectators are expected to arrive by car, with the majority arriving by rail and tube services. Similar to the football Home fans, 1% will cycle and walk.

- 15.5.79 Additional assumptions have been generated in relation to the direction of travel of NFL spectators arriving by rail. Table 15.13 and Table 15.14 set out the assumed division of demand upon arrival and departure at each station, respectively. When compared to the football scenario, the percentage of NFL spectators arriving to and departing from Central London to White Hart Lane and Northumberland Park is higher. This reflects a difference in NFL supporter travel, which is less localised and more widespread across the country. As detailed in the sections below however, measures can be put in place to reduce the impact of these constraints accordingly, to ensure minimal disruption to travel.

Table 15.13 Assumed Proportions of Spectator Arrivals by Rail from Each Direction

Station	Split of Demand ARRIVALS – Sunday Afternoon	
	From Central London (incl. those interchanging at TH and SVS)	From The North
White Hart Lane NR	78.3% (of whom 35% interchange from Victoria Line at Seven Sisters)	21.7%
Northumberland Park NR	72.7% (of whom 36% interchange from Victoria Line at Tottenham Hale)	27.3%

Table 15.14 Assumed Proportions of Spectator Departures by Rail from Each Direction

Station	Split of Demand DEPARTURES – Sunday Afternoon	
	To Central London (incl. those interchanging at TH and SVS)	To The North
White Hart Lane NR	20.8% (of whom 37% interchange to Victoria Line at Seven Sisters)	79.2%
Northumberland Park NR	25.0% (of whom 41% interchange to Victoria Line at Tottenham Hale)	75.0%

National Rail

- 15.5.80 Based on previous surveys and the assumptions made from these for the NFL games, approximately 36% of spectators travel by rail via White Hart Lane or Northumberland Park.

White Hart Lane

- 15.5.81 White Hart Lane is expected to accommodate around 22% of all NFL spectators in the pre-match period, around 5% of whom arrive from the north, with the remainder from the south.
- 15.5.82 Given that northbound trains arriving at Seven Sisters will be partially loaded with background travellers

and spectators travelling to White Hart Lane from Central London, there will be capacity constraints between 12:15 PM and 13:30 PM. As there is a finite train capacity, a potential issue for consideration is the occupancy of the northbound National Rail platform during this period.

- 15.5.83 As stated previously, TfL standard advice is to assume trains will not exceed 85% of their plated capacity. However, higher loadings are regularly observed on this route. When trains are assumed to be fully loaded on this route, as is currently the case, peak loading of the platform is between 700 and 800 passengers. Although some passengers on this platform may have to wait for one service to pass before being able to board, the queues will not be excessive.
- 15.5.84 During the post-match period, about 19% of spectators will depart White Hart Lane Station between 5:45 PM and 8:00 PM, around 5% of whom will depart to the north, with the remainder to the south.
- 15.5.85 Queues of up to 809 passengers are anticipated to form outside the station for access to the southbound platform. The platform loading will be capped at 859 people, matching the train capacity, assuming that new Class 378 rolling stock is still in use. It is anticipated that the replacement of this rolling stock will be completed in 2019. Controlled flows into the station will therefore take place in order to ensure platform capacity is not exceeded.
- 15.5.86 No queues are expected on the northbound platform, as demand does not exceed capacity.

Northumberland Park

- 15.5.87 Northumberland Park station is expected to accommodate about 11% of all NFL spectators in the pre-match period, around 3% of whom will arrive from the North, with the remainder from the south. There are no significant conflicts anticipated between spectator demand and available rail capacity either northbound or southbound at Northumberland Park.
- 15.5.88 During the post-match period, about 17% of spectators are forecast to depart Northumberland Park station between 5:45 PM and 8:00 PM with 33% to the north and the remainder to the south. The queuing anticipated for northbound services from Northumberland Park station is minimal, with a maximum queue length of 65 people, maximum queue duration of 1 minute and maximum delay of 16 minutes between arriving and boarding the train. Some queues are anticipated to form outside the station for access to the southbound platform. The maximum queue length will be 577 people with a queue duration of 29 minutes and delay of 14 minutes.

London Underground

Seven Sisters

- 15.5.89 The Seven Sisters interchange will accommodate about 30% of NFL spectators, who will arrive on the Victoria Line between 10:30 AM and 2:15 PM. Of these, 50% will exit the station and walk to the stadium, 27% will interchange to National Rail trains to White Hart Lane and 23% will interchange onto local buses to the stadium.
- 15.5.90 During the pre-match period, all station vertical circulation elements will provide sufficient capacity to accommodate the background and spectator flows without delay. This would also be the case should passengers choose not to use the stairs where there is an option between escalators and stairs.
- 15.5.91 National Rail services arriving at Seven Sisters will already be partially loaded with background travellers and spectators travelling to White Hart Lane from Central London. As is the case for other stations, TfL standard advice is to assume trains will not exceed 85% of their plated capacity, which would lead to queues. However, higher loadings are regularly observed on this route, and in discussion with TfL, a full train capacity of 1,020 has been assumed. This leads to platform loadings of up to 570 people, which can be accommodated at a reasonable density. In this scenario, for all but two periods (12:30 and 13:30), all passengers will be able to board the first train after they arrive on the platform. It is also important to highlight that the transfer to London Overground has resulted in greater levels of station staffing on major event days at this station.
- 15.5.92 During the post-match period, about 24% of NFL spectators will depart from Seven Sisters on the southbound Victoria Line. Of these passengers, 58% will arrive on foot from the stadium, 29% will interchange from National Rail train services from White Hart Lane and 13% will interchange from buses from the stadium.
- 15.5.93 To ensure that queuing and congestion do not take place inside the station, access to the station from High Road will be regulated. Queues will form outside the station and will be controlled with queue management and stewarding outside the station. All street level entry is assumed to be via the northernmost access point.
- 15.5.94 In this scenario, entry into the station would be regulated throughout at 165 people/minute (equivalent of 6 automated ticket gates and 1 wide aisle gate). However, given the rate of arrival at the station, some queues would form from 18:15 PM. The maximum queue length would be 154 people with the requirement to accommodate some level of queuing outside the station for approximately 15 minutes. The maximum delay for any individual would be less than one minute. Demand is held outside the station to prevent queue formation inside, meaning that, upon entry through the ticket gates, passengers are able to walk directly to their platform unimpeded.
- 15.5.95 During the post-match period, spectators interchanging from National Rail to shuttle bus services (having boarded at White Hart Lane, WHL) onto the Victoria Line services use different parts of the station to those arriving on foot or by bus, so no queuing is expected.
- 15.5.96 After passing from the platform through the Network Rail elements of the station, interchanging passengers will descend an escalator to the Victoria Line. Small, shuffling queues of around 100 people

are expected at the top of the escalator. Delays incurred will be less than 1 minute at the head of the escalator.

15.5.97 When interchanging from National Rail to London Underground southbound services, at the base of the escalator, passengers descend further stairs to reach the platform, with no queuing is expected. The southbound Victoria Line platform will be fed by two entry points at either end. The platform has capacity for approximately 1,000 people and as indicated in this assessment, the peak anticipated occupancy would be 400 passengers. This suggests that conditions on the platform during the post-match are operate safely without management intervention, any delay in service of more than two minutes at peak times may require access to be controlled.

15.5.98 The available capacity on trains takes into account background users and spectators boarding at Tottenham Hale. For all but three time slots (18:15, 18:30 and 19:19 PM), it will be possible for all passengers arriving on the platform to board the next train.

Tottenham Hale

15.5.99 Tottenham Hale interchange is expected to accommodate about 18% of NFL spectators during the pre-match period between 10:30 AM and 2.15 PM. Of these, 56% will exit the station and walk to the stadium, 22% will interchange onto a THFC shuttle bus, and 22% will interchange onto National Rail services to Northumberland Park.

15.5.100 With respect to vertical circulation from the Victoria Line, the demand exceeds escalator capacity on several occasions, creating small, shuffling queues of up to 40 people that remain within the reservoir area capacity at the bottom of the escalator. The peak period for this would be between 1:00 PM and 2:15 PM. Queuing would be avoided if the stair capacity were fully used in addition to the escalator, although observations suggest that this is not the natural behaviour given the steepness of the stairs. This would therefore need to be managed with encouragement of stair usage.

15.5.101 During the post-match period, about 23% of NFL spectators will arrive at Tottenham Hale Station between 5.45 PM and 8:15 PM. Of these, about 61% will arrive on foot from the stadium, 30% interchange from National Rail train services from Northumberland Park, and 17% will interchange from THFC shuttle bus services

15.5.102 Assuming four entry gates and five exit gates for the National Rail gateline, a small queue is anticipated at the exit gateline with peak entry flows forecast between 6:15 PM and 7:00 PM. All passengers alighting from National Rail services will be able to clear the gateline within two minutes of the train's arrival.

15.5.103 Some passengers alighting from the shuttle bus will board National Rail services arriving from Northumberland Park. Analysis shows that all of these spectators will be able to board the next available train after their arrival. Although trains will leave Northumberland Park 'at capacity', the number of people alighting at Tottenham Hale (to interchange to London Underground) exceeds those wishing to board, leaving sufficient capacity for those boarding. The number of people waiting on the platform to board will peak at 65, so no capacity issue is anticipated.

15.5.104 Entrance to the ticket office provides sufficient capacity to accommodate all flows entering the station. Entry into the London Underground part of the station would be via six automated ticket gates and one

wide aisle gate. This matches the vertical circulation capacity within the station, and therefore prevents any queue forming at the head of the stairs/escalator or in the gateline run-off area. This requires use of the stairs, in addition to the escalators, for vertical circulation. Some queuing is anticipated at the gateline with a maximum queue duration of 22 minutes, a maximum queue size of 399 people and a maximum delay of 3 minutes. The majority of passengers will not experience any delay.

15.5.105 As highlighted previously, each London Underground platform has capacity for approximately 1,000 people. The peak anticipated occupancy at Tottenham Hale is approximately 220 passengers for southbound services and 120 passengers for northbound. For both platforms, densities experienced are below the planning standards for Normal Operations, suggesting that conditions on the platform during the post-match will operate safely without management intervention. In both directions, all passengers would be expected to board the first train after arriving on the platform.

Bus

15.5.106 An overview of bus services for the THFC stadium has been set out within the relevant section of this chapter. With respect to the NFL scenario, the following information has been devised.

15.5.107 During the pre-match period, northbound flows on High Road have the option to use four bus routes (149, 259, 279 and 349). Most spectators are expected to interchange onto buses at Seven Sisters, although some spectators will travel on local buses from further south. Analysis suggests there may be a shortfall in capacity between 11:45 AM and 2:00 PM. However, if full plated capacity is used (and current matchday behaviour suggests that this will be the case), this capacity shortfall will be significantly reduced. It may be that interventions are put in place at Seven Sisters during this period to encourage efficient boarding and use of capacity. If there is a short-lived capacity shortfall, spectators unable to board buses may choose to walk to the stadium instead.

15.5.108 During the post-match period, southbound flows on High Road have the option to use the same four bus routes. Most spectators are expected to interchange at the Seven Sisters Station, although some spectators will travel further south on local buses. This analysis suggests that there will be no shortfalls in capacity and that every spectator will be able to board the first bus, except at 7:30 PM.

Conclusion

15.5.109 In staging NFL games at the new stadium, there will be no additional transport strategy challenges to those already being addressed by the Club. Similar to the weekday football matches, Sunday NFL spectators will be encouraged to walk, cycle or use the extensive London transport system comprised of National Rail, London Underground and London bus services.

15.5.110 Although the London transport system will be less burdened on a Sunday by low work commuter travel, constraints on these systems will still arise with respect to spectator flows, platform capacities, queue lengths, queue durations and delays. Having identified where and when these constraints arise however, they can be managed effectively and kept to a minimum so that spectator delays will be only a matter of minutes, whilst ensuring high levels of safety for spectator travel to and from the NFL games.

Stadium – Concerts

15.5.111 It is anticipated that the new stadium will be used as a venue for other major events, including concerts. Scheduling of concerts at the new stadium requires a separate licensing process, so will be covered in more detail at the time of that application. The management requirements associated with the staging of concerts are slightly different to those associated with football matches, as the behaviour of visitors is likely to differ.

15.5.112 This section presents the factors that have been used to derive a forecast of visitor travel patterns associated with a concert at the new stadium. As the current stadium does not currently host non-football major events, the assumptions are based on evidence from other stadiums. The profile of visitors' behaviour has been derived from a review of profiles recorded for concerts taking place at other London venues.

15.5.113 Forecasts have been developed for a concert scenario with projections for both 45,000 visitors and 55,000 visitors. The objective is to understand the transport-related challenges that may be associated with a concert; in particular, where they differ from those expected on a match-day.

15.5.114 The forecast has been generated and analysed using the same tools as the match-day scenarios. The key assumptions are:

- Venue capacity of 45,000 or 55,000, depending on the layout of the concert;
- The concert will take place on a Saturday evening; and
- The main act will take the stage at 8:00 PM and finish at 10:00 PM with no supporting acts.

15.5.115 The assumption that there are no supporting acts creates more acute arrival and departure profiles that would be expected in reality, leading to robust worst-case forecasts.

15.5.116 The transport demand assessment has not be fully optimised, as was the case with the Football scenario, because attendees are expected to have far less local knowledge. The results do show variances between the four stations which would be reduced by optimisation of the demand forecasts and this would be the subject of further analysis as part of the preparation of the Event Management Plan that would be a licensing requirement of LBH. Given that many spectators would wish to use the Victoria Line this could be managed through recommended route for different stadium exit points.

Arrival and Departure Profiles

15.5.117 It is assumed that:

- All attendees are in the stadium by the time the main act takes to the stage; and
- The stadium arrival profile is applied irrespective of mode of transport used, and whether or not attendees are visiting other locations in the local area prior to the event.

15.5.118 The expected arrival profile for concerts is shown in Table 15.15, reflecting the moment attendees enter the stadium from the local area. The arrival profile is relatively even, with a steady flow of visitors into the stadium between 90 and 15 minutes before the concert begins.

Table 15.15 Assumed Attendee Arrival Profile at the stadium

Minutes before kick-off	Proportion of spectators arriving - Saturday Evening
0-15 minutes before kick-off	2.5%
15-30 minutes before kick-off	10.0%
30-45 minutes before kick-off	12.5%
45-60 minutes before kick-off	12.5%
60-75 minutes before kick-off	12.5%
75-90 minutes before kick-off	12.5%
90-105 minutes before kick-off	12.5%
105-120 minutes before kick-off	7.5%
120-135 minutes before kick-off	7.5%
135-150 minutes before kick-off	10.0%

15.5.119 The stadium departure profile is shown in Table 15.16, again reflecting the moment attendees pass the gatelines back onto the public highway. This model takes into account some early departures, which tend to be a key feature of concerts. The departure profile has a peak in the first 15 minutes after the end of the concert.

Table 15.16 Assumed Attendee Departure Profile from the stadium

Minutes after End of Concert	Proportion of spectators leaving - Saturday Evening
15-30 minutes before end	5%
0-15 minutes before end	15%
0-15 minutes after end	65%
15-30 minutes after end	8%
30-45 minutes after end	8%
45-60 minutes after end	0%

National Rail

15.5.120 The two National Rail stations that will accommodate concertgoers are Northumberland Park and White Hart Lane. The splits between these two stations are shown in Table 15.17 and Table 15.18.

Table 15.17 Assumed Proportions of Attendee Arrivals by Rail from each Direction

Station	Split of Demand - Saturday Evening	
	From Central London (incl. those interchanging at TH and SVS)	From North
White Hart Lane NR	66.7%	33.3%
Northumberland Park NR	64.7%	35.3%

Table 15.18 Assumed Proportions of Attendee Departures by Rail from each Direction 45,000 Attendee Scenario

Station	Split of Demand - Saturday Evening	
	To Central London (incl. those interchanging at TH and SVS)	To North
White Hart Lane NR	68.0%	32.0%
Northumberland Park NR	66.7%	33.3%

Northumberland Park Station

15.5.121 The majority of attendees will travel towards central London from this station.

15.5.122 In the departure scenario for 55,000 attendees, queues are anticipated to form outside the station for access to the northbound platform. It is assumed that the capacity of the platform is capped at 700 people, as this broadly matches the capacity per train, and there are several occasions where access to the platform would need to be controlled. The maximum queue size would be 2,031 spectators. The longest delay for any individual from the time they arrive at the station to boarding a southbound train is 47 minutes. As is the case for football matches, this would be controlled with queue management and stewarding at the station, and will be more fully discussed as part of the separate licensing process for concerts.

White Hart Lane Station

15.5.123 In the departure scenario for 55,000 attendees, queues are anticipated to form outside the station for access to the southbound platform. The maximum delay for any individual from the time they arrive at the back of the queue to the point at which they board a train is 29 minutes. The queue will clear in approximately 65 minutes.

15.5.124 Likewise, for the 45,000-capacity scenario, queues are anticipated to form, although slightly smaller and with a shorter maximum wait time of 26 minutes and with the queue clearing completely in approximately 45 minutes.

15.5.125 The key factor affecting the clearance rate and the size of queue is the available train capacity. Again, the queue management and stewarding procedures will be resolved more fully as part of the separate licensing process for concerts.

Conclusions

15.5.126 Station capacities are not exceeded for arrivals in either of the two scenarios for stadium capacity,

15.5.127 For departures, with 55,000 attendees, 47% of attendees will wait for 10 minutes or less at White Hart Lane station to travel southbound, while only 3% will wait for 26 – 30 minutes. There is no wait to travel northbound from this station. At Northumberland Park station, 30% of attendees will wait for 10 minutes or less, while 25% will wait for more than 30 minutes travelling southbound. The strain on the northbound trains will be less than this, with 70% of attendees waiting for less than 10 minutes. Crowd management

either outside the station or at the ticket office will be an extension of the current plan in place to deal with pre- and post-match conditions at Tottenham Hotspur matches.

- 15.5.128 In departure for the 45,000 capacity scenario, 49% of attendees will wait for 10 minutes or less at White Hart Lane station to travel southbound, while only 2% of attendees will wait for more than 21 minutes. There is no delay to northbound travel. At Northumberland Park Station, 48% of attendees will wait for 10 minutes or less, while 1% of attendees will wait for more than 30 minutes. This will not require crowd management, providing vertical circulation routes are well utilised.

London Underground

- 15.5.129 The two London Underground stations that will accommodate concertgoers are the Seven Sisters Interchange and Tottenham Hale Interchange.
- 15.5.130 Crowd management will be an extension of the current plan in place to deal with pre- and post-match conditions at football matches.

Seven Sisters Interchange

- 15.5.131 During the pre-event period, the interchange flow between London Underground and National Rail is the most challenging. This is principally due to the coincidence of high attendee flows and Event Day northbound services. The assessment of the 55,000-attendee scenario shows there are occasions where some people will be unable to board the first northbound train. However, all waiting passengers will be able to board the subsequent train. No such delay exists for the 45,000 scenario.
- 15.5.132 During the post-event period, assuming that the station infrastructure continues to operate at the same level of efficiency as has been observed in existing conditions, there will be some queuing outside the station on High Road, with entry flows managed to match the internal capacity of the route through to the Victoria Line southbound platforms. The analysis indicates that any delays experienced would be a matter of minutes, although queues will be formed outside the station for up to 45 minutes. In the departure scenario for 55,000 attendees, there are some shortfalls of capacity at both stations. To ensure that queuing and congestion does not take place inside the station, access to the station from High Road will be regulated, requiring a management plan to be adopted.

Tottenham Hale Interchange

- 15.5.133 The projection for flow rates through this station are based on actual spectator throughputs at Seven Sisters station. Crowd management will be an extension of the current plan in place to deal with pre- and post-match conditions at football matches.
- 15.5.134 In the arrival scenario for both 55,000 and 45,000 attendees, and for both platforms, densities experienced are below the planning standards for normal operations, suggesting that conditions on the platform during the post-match should operate safely without management intervention.
- 15.5.135 In the departure scenario for 55,000 attendees, trains will leave Northumberland Park 'at capacity', and the number of people alighting at Tottenham Hale (to interchange to London Underground) will exceed those wishing to board. The number of people waiting on the platform to board will peak at approximately 80, so no capacity issues are anticipated. The maximum delay for any individual will be 15 minutes, with a queue duration of 63 minutes.

- 15.5.136 It is anticipated that entry to the ticket office will be controlled to match the gateline capacity so that the queues can be managed outside the building, preventing potential obstruction to interchange flows that could occur without this measure.

Conclusions

- 15.5.137 Tottenham Hale Station in its future configuration has the capacity to accommodate the forecast attendee demand in addition to 'regular' use of the station before and after a concert. This includes an uplift in demand of more than 20% in the period up to the forecast year of 2021.
- 15.5.138 During the pre-concert period, the critical capacity constraint is the vertical circulation between the Victoria Line platform level and the ticket office, with the limited area at the base of the escalator/stairs before the queues form back as far as the platform. Calculations suggest that to avoid extensive queuing in this area, it is important that high train frequencies are maintained (to spread demand across more trains) and that use of the stairs is encouraged.
- 15.5.139 In the post-concert period, queuing is anticipated at the entrance to the station for those arriving on foot or by shuttle bus. Again, vertical circulation is the key constraining factor.
- 15.5.140 The peak queue in the 55,000-attendee scenario would be 2,031 people and some crowd management is therefore required. However, it is not anticipated that any individual would be delayed for more than 15 minutes. Crowd management will be an extension of the current plan in place to deal with pre- and post-match conditions at football matches.

Bus

- 15.5.141 If full plated capacity is used (and current Major Event Day behaviour suggests that this could be the case), any capacity shortfall will be significantly reduced. It may be that interventions are put in place at Seven Sisters during this period to encourage efficient boarding and use of capacity. If there is a short-lived capacity shortfall, and it is more than 30 minutes before the event starts, attendees unable to board buses may choose to walk to the stadium instead.
- 15.5.142 In the 55,000-attendee scenario, there is a small shortfall in arrivals. However, if managed efficiently as suggested above, this will be significantly reduced. If interventions at Seven Sisters are put in place during the periods of peak use, the shortfall will be short-lived. As it will occur more than 30 minutes before the event starts, attendees unable to board buses have time to walk to the stadium instead, if they so choose.
- 15.5.143 In the 45,000-attendee scenario, there is available capacity to accommodate all attendees, although this may rely on interventions in place at Seven Sisters during peak use periods to encourage efficient boarding and use of capacity.
- 15.5.144 There is no shortfall in capacity for departures in either the 55,000 or 45,000 capacity scenarios.

Conclusions

- 15.5.145 Most attendees (72%) will arrive between 15 – 105 minutes before the start of the concert. The flow of attendees is consistent throughout this period. National Rail and London Underground services will experience the greatest proportion of attendees arriving directly to the stadium. In the 55,000-attendee

scenario, Tottenham Hale Station will experience queues at the bottom of the escalator, and there are possible shortfalls in capacity for the shuttle bus for one hour (18:30 – 19:30). This would not translate into a risk to safety. In both of these, delays to attendees may be reduced by effective operational loading and capacity management.

15.5.146 Although there are minor shortfalls in capacity, this would not translate into a risk to safety or station operations.

15.5.147 Most attendees (65%) will depart the stadium within 15 minutes of the end of the concert. Because of this acute demand, there will be greater strain on all modes of transportation. National Rail and London Underground would experience the greatest proportions of attendees departing. However, this does not translate to a risk to safety or station operations. Crowd management will be an extension of the current plan in place to deal with pre-Event and post-Event conditions at football matches.

15.5.148 In the 55,000-capacity scenario, the greatest delays would take place on the National Rail and London Underground. Seven Sisters Station would experience a queue lasting 40 minutes, with no individual waiting more than 13 minutes. Tottenham Hale would experience a queue for 63 minutes, with no individual waiting more than 15 minutes. Northumberland Road would experience a queue for 90 minutes, with 80% of individuals waiting less than 20 minutes. White Hart Lane would experience a queue for 65 minutes, with 90% of individuals waiting less than 20 minutes. Where queues exist, they can be managed with queue management and stewarding measures, details of which will be resolved as part of a separate concert licensing process, but is likely to be an extension of the current plans in place to deal with pre- and post-match conditions at football matches.

15.5.149 In neither of the two capacity scenarios do any of the capacity constraints translate into a risk to safety or station operations.

Residential Units and Serviced Apartments

15.5.150 The best comparator for the proposed development is felt to be the residential units associated with the Emirates Stadium project. Here, even at parking ratios of 0.62-0.82 spaces per unit, there are still some unallocated spaces. The actual utilization is closer to 0.55 spaces per apartment. The trip generation per unit is 0.14 two way trips per day, i.e. two trips per week.

15.5.151 Taking into account the census data for journey to work by car and public transport, and the previous trip generation assumptions, it is proposed that for the revised NDP proposals a daily trip rate of 3.5, a car trip rate per unit of 0.31, compared to 0.14 at Holloway, and an 8.9% car use compared to 4.1% at Holloway. The key car trip rate for a car owning household in the new development would be 0.67 per unit with a car mode share of 19%.

15.5.152 The analysis indicates that there would be approximately:

- 39 cars entering or leaving the site in the morning peak;
- 37 cars entering or leaving the site in the evening peak; and
- 200 cars entering and 200 cars leaving the Project Site every day (total c.400).

15.5.153 These trips would result in a very modest impact on the surrounding highway network. It is considered that there would be no significant impact on the network.

Tottenham Experience and Non-Major Event Day Attractions

15.5.154 The proposed Non Major Event Day activities include:

- The Tottenham Experience
- Conferences and banqueting
- Sky Walk
- Extreme Sports Centre

15.5.155 Estimates for the number of visitors have been made using relevant comparators. Cautious assumptions for combined trips and allowances for variations on a day to day basis have been incorporated into the analysis. On a busy day it is estimated that the combined visitor attractions would generate 1,655 person trips to and from the local area.

15.5.156 The modal split assumptions/targets are that 10% of the journeys would be cars/taxis with an average occupancy of 2 visitors per trip. Half (50%) of the visitors are assumed to use the local rail services at White Hart Lane and Northumberland Park before walking to the stadium.

15.5.157 A total of 20% of visitors are assumed to use local bus services – in particular the services that connect to the Victoria Line at Seven Sisters station. 5% of visitors are expected to arrive in organised coaches – which would be equivalent to 2-3 coach trips per day. Finally, 5% of visitors will walk or cycle to the visitor attractions. However, it is expected that these figures will change on a day to day basis depending on the activities running at the time.

15.5.158 The trips generated by the health centre and hotel have also been estimated and the cumulative impact of the southern development considered including the residential elements and the Tottenham Experience.

15.5.159 The numbers of vehicles using the Park Lane/High Road Junction has been forecast, including the trips generated by the new development. The key conclusion is that even with the additional trips from the southern development, the total vehicle flows of up to 1,374 in the peak hour of 0800 - 0900 are less than those previously forecast for a 2016 baseline (1,662 vehicles in the AM peak), without the southern development. This is due to the fact that background traffic flows have decreased significantly over the last few years. Therefore it is not considered that there will be a significant impact on the highway network.

15.5.160 It is therefore concluded that none of these outcomes are likely to cause any significant impacts on with travel capacity in the local transport networks.

15.6 Additional Mitigation, Compensation and Enhancement Measures

Construction

15.6.1 The key mitigation measure for construction traffic will be the effective caps of 75 HGV arrivals and departures per day. THFC will seek to maximise the re-use of the excavated material to minimise the spoil removal and the future need to import aggregate – a double benefit. The use of a local work site will also reduce the length of construction vehicle trips for concrete deliveries.

Vehicle Routing

- 15.6.2 Without the Construction Compound site all the construction traffic would route to the stadium construction site by way of the A1010 High Road/Fore Street that connects to site to the A406 North Circular Road. This route has been adhered to in the previous stages of the Northumberland Development Project construction. This would still be the route for the construction traffic other than the concrete deliveries.

15.7 Assessment Summary and Residual Environmental Impacts and Effects

Introduction

- 15.7.1 This report considers a range of transport issues associated with the redevelopment of the THFC stadium, located in the northeast of the London Borough of Haringey. The Project comprises a new world class stadium with a capacity of 61,000, with provision of a range of new facilities which will enhance the event day experience for spectators.
- 15.7.2 The document 'Transport Assessment Volume 2 – Existing Conditions' provides a description of the existing stadium, establishing the baseline environment from which the relative event-day impacts of the proposed stadium upgrade have been assessed.

Planning Policy

- 15.7.3 The planning submission has been developed within a framework of national, regional and local planning policies and guidance. National guidance sets the general objectives, with regional and local policies creating more specific guidance relevant to the local setting.
- 15.7.4 For developments, the policies promote two main aims for transport – to promote non-car travel, and to maintain free-flowing road networks. The new stadium achieves these aims through a broad set of measures aimed at encouraging local trips, constraining parking through the increased CPZ, improving cycling, walking and public transport routes, increasing public transport capacity, and using improved communication with spectators to encourage and balance use of the available public transport nodes.

Transport Strategy

- 15.7.5 The development of the stadium has been founded on a transport strategy which focuses on removing the barriers to sustainable travel, assisted by the provision of an expanded event day CPZ covering 716 hectares.
- 15.7.6 The site is very well served by public transport in the form of buses, rail access and the London underground, with Seven Sisters and Tottenham Hale stations, located to the south of the Project Site, acting as key transport interchanges. This level of provision, coupled with the management plans being promoted through the new stadium, will help to shape the way in which future spectators will choose to travel.
- 15.7.7 The TfL London Travel Report 2007 presents statistics which indicate that should the bus service provision trends be projected forwards then the future service provision would be sufficient to meet the proposed demand for bus services to and from Seven Sisters station. However, THPCL are committed to providing financial support to TfL in order to bring forward any improvements to bus travel capacity. Furthermore, new stops, changes to bus stop locations, a new diversion route, and junction

improvements will all serve to additionally support the increased demand.

Trip Generation and Assessments

Stadium

- 15.7.8 The trip generation associated with the regenerated stadium proposals was established using assessments of the local transport capacities, existing transport surveys, match day questionnaires and validated using experience from the recently built Emirates stadium, which has a similar fan base. In addition the effect of improving the onsite facilities is shown to attract and retain spectators, so that they arrive early and remain on site following an event. This reduces the peak demands normally associated with arriving and departing spectators.
- 15.7.9 The resulting assessments have shown that the improved stadium and associated improved public realm, with support from stewarding and effective management, will be able to disperse spectators much more efficiently than is currently experienced at the existing stadium, such that any High Road diversions could be lifted within 20 minutes of an event ending. Diversions are currently in place for approximately 30 minutes. This is largely the result of away fans being located in the prominent southwest corner of the site. The proposed stadium will see them relocated to the northeast corner and closer to the coach parking.
- 15.7.10 Assessments of the rail and underground impact have demonstrated that post-event management at the relevant entry points will be required in order to safely regulate access, and a range of proposals have been reported to allow this to be implemented. Improvements to station facilities will also support the increased numbers, as part of which THPCL is proposing to adopt White Hart Lane station and to contribute towards works to Tottenham Hale LUL station.
- 15.7.11 To provide a robust assessment the capacity assessments have been undertaken with the stadium impact at full capacity, and have shown that the various transport access points are cleared of spectator queuing well within an hour.
- 15.7.12 The Coach Travel Strategy will identify a package of proposals that, as a longer term goal, will make it conceivable for up to 5% of home supporters to travel by coach, rising over time from the currently proposed 2.5% mode share. This provides a scenario within which many of the impacts on other modes could be reduced.
- 15.7.13 The concert scenario presents a case whereby the transport network is at the limit of what is likely to be an acceptable outcome in terms of queues and delays. Further mitigation measures are likely to be necessary. The means of improving the reported outcome will be delivered as part of the transport strategy for the license application for any particular event.
- 15.7.14 Work on the Transport Assessment so far has included both generalised demand forecasting and more detailed mode-by-mode analysis of the capacity of the public transport routes and capability of existing and future networks to carry the increased demand that is expected.
- 15.7.15 This report has demonstrated that with the proposed mitigation measures and transport management plans in place, agreed between THPCL, the London Borough of Haringey, and the Metropolitan Police Service, there is sufficient capacity to safely and effectively transport the anticipated spectator demand to and from the stadium.

Table 15.19 Traffic and Transport Assessment Summary

Environmental Effect	Sensitivity of Receptor	Nature of Impact	Impact Magnitude	Significance	Additional Mitigation	Residual impact Magnitude	Residual Significance of Effect
Construction Effects							
Excavation activity, site preparation, piling and foundations - HGV Impact on highway network	Low	Negative	Low	Minor	Routeing and scheduling of construction HGVs and delivery times	Very Low	Minor - Neutral
Construction of stadium – HGV Impact on highway network	Low	Negative	Medium	Minor	Routeing and scheduling of HGVs and delivery times Use of construction compound near White Hart Lane Stations	Very Low	Minor - Neutral
Construction of southern area uses – HGV Impact on highway network	Low	Negative	Very Low	Neutral	Routeing and scheduling of construction HGVs and delivery times	Very Low	Minor - Neutral
Operational Effects							
Cumulative additional trips on the highway network. Local roads around the Project Site eg Park Lane (non-event day)	Low	Negative	Low	Minor	Local traffic flows much lower. Local traffic congestion reduced by northern development highway improvements. New CPZ implemented by LBH. Major scheme to remove Tottenham Hale Gyratory.	Low	Minor
Cumulative additional trips on rest of the highway network (non-event day)	Very Low	Negligible	Negligible	Neutral	Local traffic flows much lower. Local traffic congestion reduced by northern development highway improvements. New CPZ implemented by	Negligible	Neutral

					LBH. Major scheme to remove Tottenham Hale Gyratory.		
Additional passengers on rail services, Underground services and bus services (non-event day)	Low	Negligible	Negligible	Neutral	Once completed service enhancements and station upgrades will improve the passenger experience. Improvements at Seven Sisters interchange. New bus station at Tottenham Hale. New Victoria Line timetable with increased frequency. New Tottenham Hale railway station, new Overground rolling stock. Upgrades to pedestrian environment along the High Road.	Medium positive	Minor positive
Pedestrians along the High Road. Additional pedestrians on non-event days	Medium	Negative	Low	Minor	Reconfiguration of footways along the High Road	Very Low	Minor
Event Day Road Closures	Low	Negative	Medium	Minor	Time that Road closures are in operation on event days will be reduced.	Negligible	Neutral
Additional queues at rail stations and Underground stations event days. Impact on background users.	Medium	Negative	Medium	Moderate	Better pedestrian routes to public transport facilities Station Management Plans in operation Enhanced transport services and station improvements eg Seven Sisters Interchange. Event day CPZ has been	Low	Minor

					extended. New Victoria Line timetable with increased frequency. New Tottenham Hale railway station, new Overground rolling stock, new shuttle bus services. Upgrades to pedestrian environment along the High Road.		
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16. Microclimate

16.1 Introduction

- 16.1.1 This chapter of the Environmental Statement (ES) reports the findings of an assessment of the likely significant wind microclimate effects of the Project. In particular it considers the potential effects of wind upon pedestrian comfort and safety and summarises the findings of a series of wind tunnel tests. The full results of the wind tunnel tests are presented within Appendix 16.1.
- 16.1.2 This chapter and the full technical report, has been prepared by BMT Fluid Mechanics. The chapter describes the relevant policies, the methods used to assess the potential effects, and potential effects on wind microclimate at the completed Project.
- 16.1.3 Where appropriate, the mitigation measures required to reduce adverse effects are identified within the chapter, alongside a summary of the expected residual effects.

16.2 Assessment Criteria and Methodology

Previous Assessment

- 16.2.1 The previously consented scheme has been assessed via wind tunnel testing in September 2014, identifying a number of wind hotspots, principally within the podium area to the south.
- 16.2.2 Subsequently, the massing of the developments in the podium area has been altered to the extent that the current assessment supersedes the results of the previous work.

Scoping Opinion

- 16.2.3 Although a formal Scoping Opinion was not sought the Scope of the EIA was based on the technical scope for the original 2010 ES and the Southern Addendum. A draft Scoping Report was sent to the Council on the 19th June 2015, for their informal comments and discussion. No informal comments were received in relation to the Microclimate assessment.

Legislative Context

- 16.2.4 The legislative context relating to the wind microclimate is contained within the national, regional and local planning policies.

Planning Policy and Guidance

- 16.2.5 The following sections of this chapter review the national, regional and local planning policy requirements in terms of wind microclimate.

National Planning Policy

- 16.2.6 The UK wide National Planning Policy Framework (NPPF) came into force in March 2012⁴⁴. There are no

⁴⁴ National Planning Policy Framework, 2012

national planning policies directly relating to wind microclimate issues; however, the benefits of a high quality built environment are emphasised in the NPPF. An example of this is presented in paragraph 58: "...using streetscapes and buildings to create attractive and comfortable places to live, work and visit..."

Regional Planning Policy

- 16.2.7 The planning guidance contained within the London Plan: Spatial Development Strategy for Greater London, published March 2015⁴⁵, consolidates the London Plan 2011⁴⁶ with the Revised Early Minor Alterations to the London Plan, published in October 2013⁴⁷, and the Further Alterations to the London Plan, draft published in January 2014⁴⁸.
- 16.2.8 The planning guidance contained within the London Plan 2011 places great importance on the creation and maintenance of a high quality environment for London. Under Policy 7.6B 'Architecture' the plan states that "...buildings and structures should:
- Be of the highest architectural quality;
 - Be of a proportion, composition, scale and orientation that enhances, activates and appropriately encloses the public realm;
 - Not cause unacceptable harm to the amenity of surrounding land and buildings, particularly residential buildings, in relation to privacy, overshadowing, wind and microclimate;
 - Incorporate best practice in resource management and climate change mitigation and adaptation;
 - Provide high quality indoor and outdoor spaces and integrate well with the surrounding streets and open spaces; and
 - Be adaptable to different activities and land uses, particularly at ground level."
- 16.2.9 Under Policy 7.7 – Location and Design of Tall and Large Buildings, the London Plan states that:
- 16.2.10 "Tall and large buildings should be part of a plan-led approach to changing or developing an area by the identification of appropriate, sensitive and inappropriate locations. Tall and large buildings should not have an unacceptably harmful impact on their surroundings;
- a) *Applications for tall or large buildings should include an urban design analysis that demonstrates the proposal is part of a strategy that will meet the criteria below. This is particularly important if the site is not identified as a location for tall or large buildings in the borough's LDF;*
 - b) *Tall and Large Buildings should: ... b) only be considered in areas whose character would not be affected adversely by the scale, mass or bulk of a tall or large building;... f) have ground floor activities that provide a positive relationship to the surrounding streets;*
 - c) *Tall buildings should not affect their surroundings adversely in terms of microclimate, wind turbulence..."*

- 16.2.11 Wind microclimate is therefore an important factor in achieving the desired planning policy objective.

⁴⁵ Greater London Authority (2015); 'The London Plan, The Spatial Development Strategy for London Consolidated with Alterations since 2011', London

⁴⁶ Greater London Authority (2011); 'The London Plan, Spatial Development Strategy for Greater London', London

⁴⁷ Greater London Authority (2013); Revised Early Minor Alterations to the London Plan

⁴⁸ Greater London Authority (2014); Draft Further Alterations to the London Plan

Additionally, consideration of pedestrian comfort has been referenced in Policy 5.3 - Sustainable Design and Construction, Policy 6.10 - Walking, Policy 7.4 - Local Character and Policy 7.5 - Public Realm and although no specific reference is made to wind microclimate, would imply the inclusion of wind as a factor for assessing levels of comfort within London's external spaces.

- 16.2.12 The Revised Early Minor Alterations to the London Plan set out minor changes to London Plan 2011 Policy. These amendments do not affect the policies described above. In addition they do not contain any additional policies that are of relevance to wind microclimate.
- 16.2.13 In January 2014, the Mayor published draft Further Alterations to the London Plan for a twelve week period of public consultation. These alterations were considered at an Examination in Public held in September 2014 and published in March 2015. The Further Alterations do not affect the guidance already noted in the London Plan 2011 with respect to wind microclimate.

Local Planning Policy

- 16.2.14 Haringey's Local Plan: Strategic Policies, published in March 2013⁴⁹, and corresponding saved policies from the superseded UDP⁵⁰ do not contain any planning policies directly relating to wind microclimate issues.

Guidance/Best Practice

- 16.2.15 The Sustainable Design & Construction, Supplementary Planning Guidance (SPG), published in April 2014⁵¹, under Section 2.3.7 'Micro-climate' states *"Large buildings have the ability to alter their local environment and affect the micro-climate..... One way to assess the impact of a large building on the comfort of the street environment is the Lawson Comfort Criteria. This tool sets out a scale for assessing the suitability of wind conditions in the urban environment based upon threshold values of wind speed and frequency of occurrence. It sets out a range of pedestrian activities from sitting through to crossing the road and for each activity defines a wind speed and frequency of occurrence. Where a proposed development is significantly taller than its surrounding environment, developers should carry out an assessment of its potential impact on the conditions at ground level, and ensure the resulting design of the development provides suitable conditions for the intended uses"*.
- 16.2.16 The assessment of environmental wind flows in the built environment lies outside the scope of internationally recognised wind codes, which focus on wind loading issues. In addition, there are no handbooks or engineering methods from which reliable assessments of the complex environmental wind flows that shape the pedestrian level wind conditions can be derived and numerical / computational methods such as computational fluid dynamics do not readily apply to turbulent wind flows in the built environment.
- 16.2.17 A purposely-designed boundary layer wind tunnel study is the most well-established and robust means of assessing the pedestrian wind microclimate. It enables the wind conditions at the site to be quantified and classified in accordance with the widely accepted Lawson Criteria for comfort and safety.

⁴⁹ London Borough of Haringey (2013); 'Haringey's Local Plan: Strategic Policies 2013-2026', London

⁵⁰ London Borough of Haringey (2013); 'Haringey Unitary Development Plan Saved Policies (Post Local Plan Adoption)', London

⁵¹ Greater London Authority (2014); 'Sustainable Design & Construction, Supplementary Planning Guidance', London

Baseline Data Collection

- 16.2.18 Baseline conditions at the Project Site have been assessed via an experience based desk study. Consequently, no baseline data has been acquired.

Assessment Methodology

- 16.2.19 The wind tunnel test results deliver a detailed assessment of the mean and gust wind conditions around the existing site and the Project for all wind directions in terms of pedestrian comfort and safety.
- 16.2.20 The methodology for quantifying the pedestrian level wind environment of the existing site and the Project is outlined below:
- Step 1: Measure the building-induced wind speeds at pedestrian level in the wind tunnel;
 - Step 2: Adjust standard meteorological data to account for conditions at the site;
 - Step 3: Combine these to obtain the expected frequency and magnitude of wind speeds at pedestrian level; and
 - Step 4: Compare the results with the Lawson Criteria to 'grade' conditions around the site by reference to the planned/desired pedestrian activities.

Simulation of Atmospheric Winds

- 16.2.21 Wind is unsteady or gusty, and this 'gustiness' or turbulence varies depending upon the site. Modelling these effects is achieved by a series of grid, barrier and floor roughness elements to create a boundary layer that is representative of urban or open country conditions, as is appropriate.

Meteorological Data

- 16.2.22 Wind microclimate studies require that wind speed data obtained from a measurement station be transposed to the site of interest. The wind speed history, provided by weather centres such as the London Heathrow, is reformatted into the number of observations of mean hourly wind speeds within each of several wind speed ranges, for each wind direction and for each month of the year.
- 16.2.23 A mathematical model (the Weibull cumulative distribution) is then used to determine the probability that, for a given wind direction, a particular wind speed, will be exceeded.
- 16.2.24 The resulting weather centre wind data is transposed to open country terrain at sea-level, accounting for upwind terrain, topography and altitude for the weather centre, before being transposed to reference height at the site of the Project, accounting for upwind terrain, topography and altitude for the target site. The resulting annual and seasonal directional and wind speed probability distributions at the site, at a reference height of 50m above ground (the approximate height of the Project), are given in Figure 16.1 and Figure 16.2, respectively. As illustrated within these figures, the most frequent winds and the strongest winds at the site blow from South-West (225° E of N). These winds are the most common cause of problematic wind comfort conditions due to strong ground level wind acceleration around buildings.
- 16.2.25 North-easterly winds are common during spring. South-easterly winds are generally light, rarely occurring and usually do not cause adverse impacts on pedestrian level winds.

Measurement Technique and Data Analysis

- 16.2.26 Wind speed measurements at assessment locations were made using probes capable of measuring fluctuating pressure differences that are calibrated against wind speed. A system of probes running simultaneously was used to obtain results from 99 locations at a height corresponding to 1.5m at full scale.
- 16.2.27 Measurements were taken for a full range of wind directions in increments of 22.5° (0° coinciding with OS grid north). Recordings were taken for a sufficient length of time to determine the mean and gust wind speeds.
- 16.2.28 For each location the measured wind speeds were combined with long-term wind frequency statistics to assess the wind environment in terms of the exceedance of threshold wind speeds that relate to comfort levels for the intended/desired pedestrian use/activity, and to safety. Wind frequency statistics, covering a period of 10 years, were obtained from the London Heathrow weather centre and transposed, accounting for variations in terrain between the site and the weather centre, to apply directly to the site.

Figure 16.1: Annual and Seasonal Directional Probability Distribution at Site

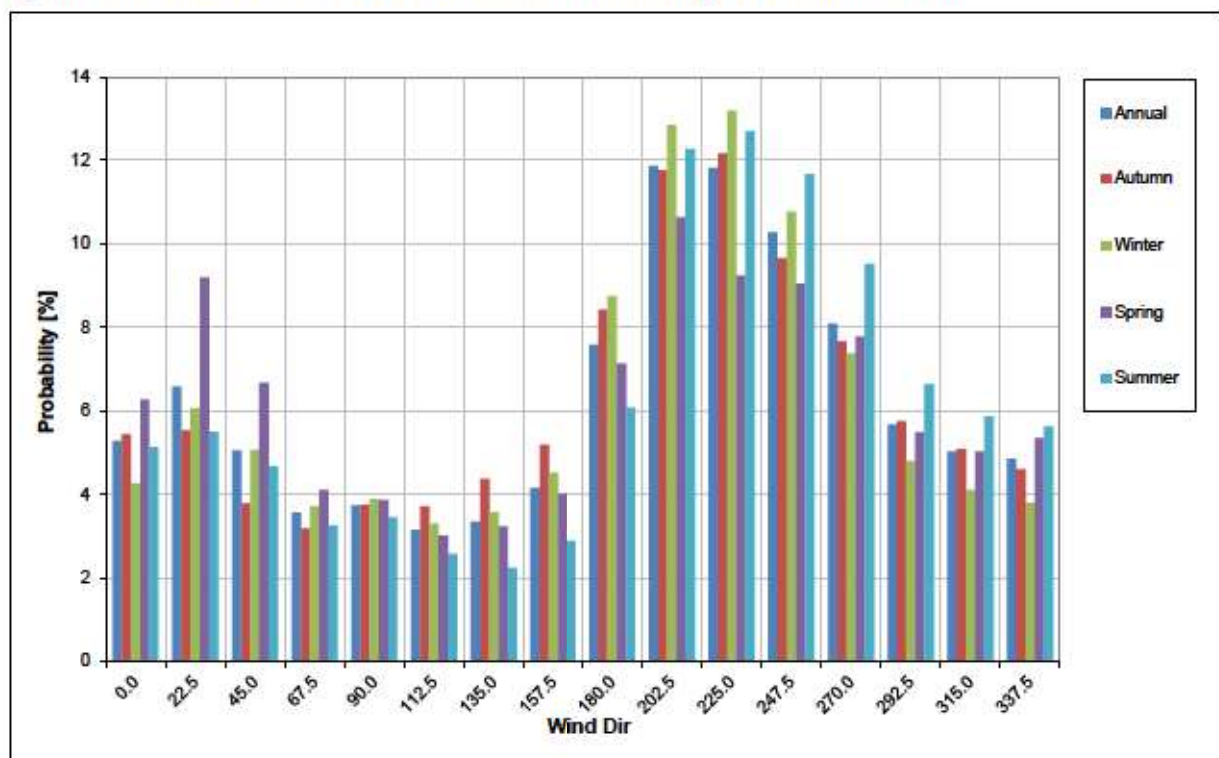
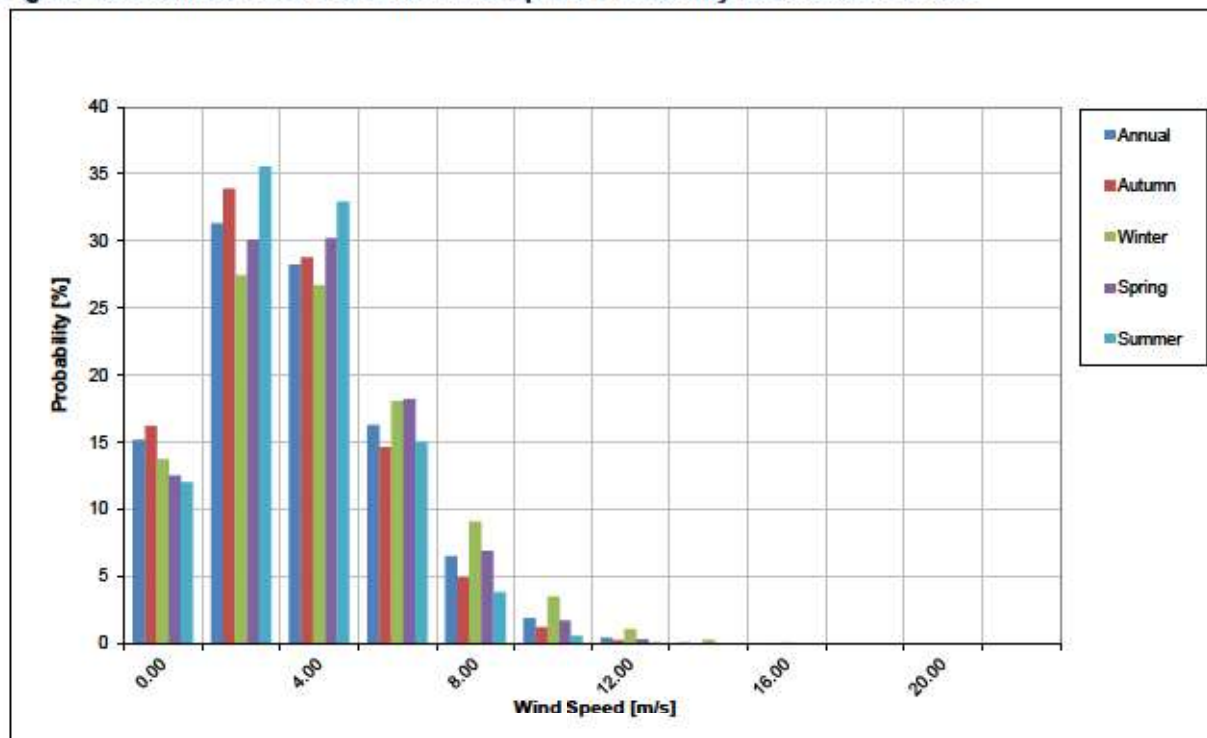


Figure 16.2: Annual and Seasonal Wind Speed Probability Distribution at Site



Assessment Criteria

Pedestrian Safety Criteria

- 16.2.29 At each area investigated, the suitability of the pedestrian level wind environment in terms of safety is assessed based on the Lawson criteria for pedestrian safety⁵². Safety is determined for the 'able-bodied' and for the 'general public'. For the general public a wind speed of 15 metres-per-second occurring once per year is rated as unsafe, with the potential to de-stabilise the less able members of the public including the elderly, cyclists and children. Able-bodied users are more likely to be capable of defending themselves against extreme pedestrian level winds and thus experience distress at a higher threshold wind speed of 20 metres-per-second, once per year.
- 16.2.30 Details of the safety criteria are presented in Table 16.1 and are based on the exceedance of the threshold wind speeds, based on the mean hourly value and on the gust equivalent mean value, occurring once per annum.

⁵² London Docklands Development Corporation (1990); The Evaluation of the Windiness of a Building Complex before Construction, T V Lawson

Table 16.1: The Lawson safety criteria

Threshold Mean-hourly Wind Speed Exceeded Once per Annum	Safety Rating		Qualifying Comments
> 15 m/s	S2	Unsuitable for general public	Less able and cyclists find conditions physically difficult
> 20 m/s	S1	Unsuitable for able-bodied	Able-bodied persons find conditions difficult. Physically impossible to remain standing during gusts.

Pedestrian Comfort Criteria

- 16.2.31 The assessment of wind conditions requires a 'standard' against which to benchmark the microclimate. The Lawson Comfort Criteria (LCC) has been established for around thirty years and have been widely used on building developments across the UK.
- 16.2.32 Lawson devised a scale for assessing the suitability of wind conditions in the built environment. The LCC define a range of pedestrian activities from sitting through to more transient activities such as crossing the road, and for each activity define a threshold wind speed and frequency of occurrence beyond which the wind environment would be unsuitable for the stated activity. The wind speeds and activities are described in Table 16.2.
- 16.2.33 The criteria reflect the fact that sedentary activity, such as sitting, requires a low wind speed for a reasonable level of comfort whereas for more transient activity (such as walking) pedestrians would tolerate stronger winds.
- 16.2.34 If the wind conditions exceed the threshold then the conditions are unacceptable for the stated activity. If the wind conditions are below the threshold then they are described as tolerable (or suitable) for the stated activity.

Table 16.2: The Lawson comfort criteria

Threshold Mean-hourly Wind Speed Exceeded < 5% of the Time	Comfort Rating / Activity		Qualifying Comments
4m/s	C4	Long-term sitting	Reading a newspaper and eating and drinking.
6m/s	C3	Short periods of standing / sitting	Appropriate for bus stops, window shopping and building entrances.
8m/s	C2	Strolling	General areas of walking and sightseeing.
10m/s	C1	Pedestrian transit (A-B)	Local areas around tall buildings where people are not likely to linger.
> 10m/s	C0	Uncomfortable for all users	Uncomfortable for all pedestrian activities.

16.2.35 The assessment takes full account of seasonal variations in wind conditions and pedestrian activities. For example, conditions for recreational activities focus on summer, but also consider spring and autumn, whilst conditions for pedestrian thoroughfare, access or waiting (e.g. bus stops) consider all seasons, with winter usually being the critical season. The pedestrian level wind environment assessment is summarised in terms of suitability for various activities.

16.2.36 The activities considered, and their relation to the LCC, are summarised in Table 16.3.

Table 16.3: Suitability assessment

Suitability	Lawson Comfort Criteria
For long periods of sitting such as for an outdoor café.	'Long-term sitting' in summer.
For pedestrian ingress/egress at a building entrance, or short periods of sitting or standing such as at a bus stop, taxi rank, meeting point, etc.	'Standing or short-term sitting' in all seasons.
For leisure uses excluding long periods of outdoor sitting such as a park, children's play area, etc.	'Standing or short-term sitting' from spring to autumn.
For access to and passage through the Project Site and surrounding area.	'Pedestrian Transit' / 'Walking or strolling' in all seasons.

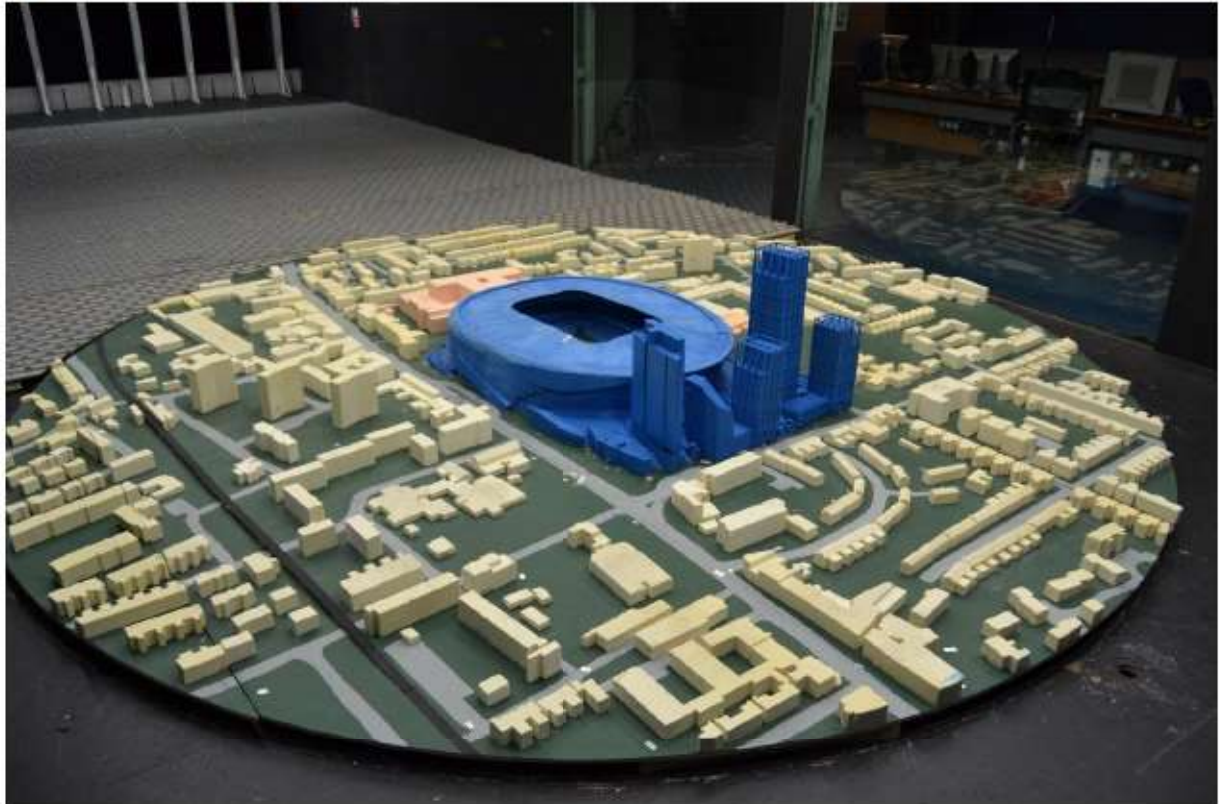
Significance Criteria

- 16.2.37 With respect to wind microclimate, the significance of the environmental effects of the Project is based on the suitability of wind conditions at each location assessed within the study area against either the current or planned pedestrian activities (as appropriate), based upon the LCC. As such the locations and activities beyond the redline boundary of the Project (i.e. pedestrian footpaths) that would remain unchanged post development would be assessed against current activities; and where the introduction of the Project would alter the existing activities and built form, the associated locations would be assessed against the planned / desired activity.
- 16.2.38 In summary, the following criteria were used to assess likely wind conditions as a result of the Project:
- 16.2.39 **Major Beneficial:** Any effect on wind conditions which potentially improves pedestrian safety (such as an improvement in conditions from being considered unsafe to being considered safe).
- 16.2.40 **Moderate Beneficial:** Any effect on wind conditions that improves pedestrian comfort from unsuitable to suitable for planned activities.
- 16.2.41 **Minor Beneficial:** Any effect on wind conditions which improves pedestrian comfort from unsuitable to marginal/tolerable for planned activities, or from marginal/tolerable to suitable for planned activities.
- 16.2.42 **Negligible:** Any effect that does not alter the suitability of existing wind conditions with respect to planned activities.
- 16.2.43 **Minor Adverse:** Any effect on wind conditions which worsens pedestrian comfort from suitable to marginal/tolerable for planned activities, or from marginal/tolerable to unsuitable for planned activities.
- 16.2.44 **Moderate Adverse:** Any effect on wind conditions that worsens pedestrian comfort from suitable to unsuitable for planned activities.
- 16.2.45 **Major Adverse:** Any effect adversely affecting pedestrian safety.

Geographical Scope

- 16.2.46 A 1:200 scale model of the existing buildings at and surrounding the site within a 440 metre (m) radius of the centre of the site was constructed. The building proposals as part of the Project were also constructed and used on the wind tunnel model (shown in Figure 16.3).

Figure 16.3: Photograph of the scale model in the wind tunnel (looking North-East)



- 16.2.47 The wind tunnel model was instrumented to measure the building-induced wind speeds at pedestrian level in and around the podium area of the Project, which has previously been identified as the area in which windier conditions may prevail.

Cumulative Developments

- 16.2.48 Based upon the Cumulative Development Schedule provided by the design team, the cumulative effect on the wind conditions in and around the Project is considered **negligible** given that there are no significant cumulative developments that would impact the wind microclimate within the modelled radius of 440m from the site.

Assumptions and Limitations

- 16.2.49 The wind tunnel model included deciduous trees in order to obtain conservative results.
- 16.2.50 As noted above, the baseline conditions for the Site have not been directly assessed by the wind tunnel tests. Instead, professional judgement has been used to assess baseline conditions.
- 16.2.51 Furthermore, the conditions for the Site during demolition and construction have not been directly assessed by the wind tunnel tests. Instead, professional judgement has been used to assess conditions during construction.

16.2.52 The scheme model has been constructed based on the design information supplied by the Design Team.

16.3 Baseline Conditions

16.3.1 Baseline conditions at the Project Site have been assessed via an experience based desk study.

16.3.2 Wind conditions within the vicinity of the existing site and within the surrounding area are largely considered to be suitable, both in terms of pedestrian comfort and safety, for the intended usage.

16.3.3 However, exceptions to this may occur, most noticeably where the massing of the existing stadium is more significant, where downdraughts and acceleration of the flow around corners could result in windier conditions.

16.4 Inherent Design Mitigation

16.4.1 Throughout the design of the Project, consideration has been given to microclimatic conditions of the surrounding receptors and amenity spaces. The consultants attended Design Team Meetings when massing and siting were being considered which highlighted areas of potential concern, assisting with the design process.

16.5 Potential Environmental Impacts and Effects and Additional Mitigation, Compensation and Enhancement Measures

Construction

16.5.1 During the demolition and construction works, there would be potential for wind to blow into and across any open areas of the site. However, given the dusty and untidy conditions typical of a construction site, pedestrians moving within the area would be expected to have lowered expectations, in terms of comfort. On this basis there are not expected to be any potential significant effects resulting from demolition works.

16.5.2 As construction of the Project progresses, the wind environment would gradually adjust to those of the completed project described below.

Occupation

16.5.3 The occupation of the Project has been assessed over multiple stages to provide an interim assessment of the opening day scenario, the impact of the construction phasing and the completed project conditions.

16.5.4 Opening Day Scenario (i.e. Stadium, Tottenham Experience, first storey of Health Centre and opening day Podium)

16.5.5 Full details of the suitability assessment for the opening day scenario, namely the stadium, shop, first storey of the health centre and opening day podium, without soft landscaping and wind mitigation measures and with existing surrounding buildings are presented in graphical format in Figures 16.4a and 16.4b.

Figure 16.4a: Wind microclimate summary for the opening day scenario, southern podium area

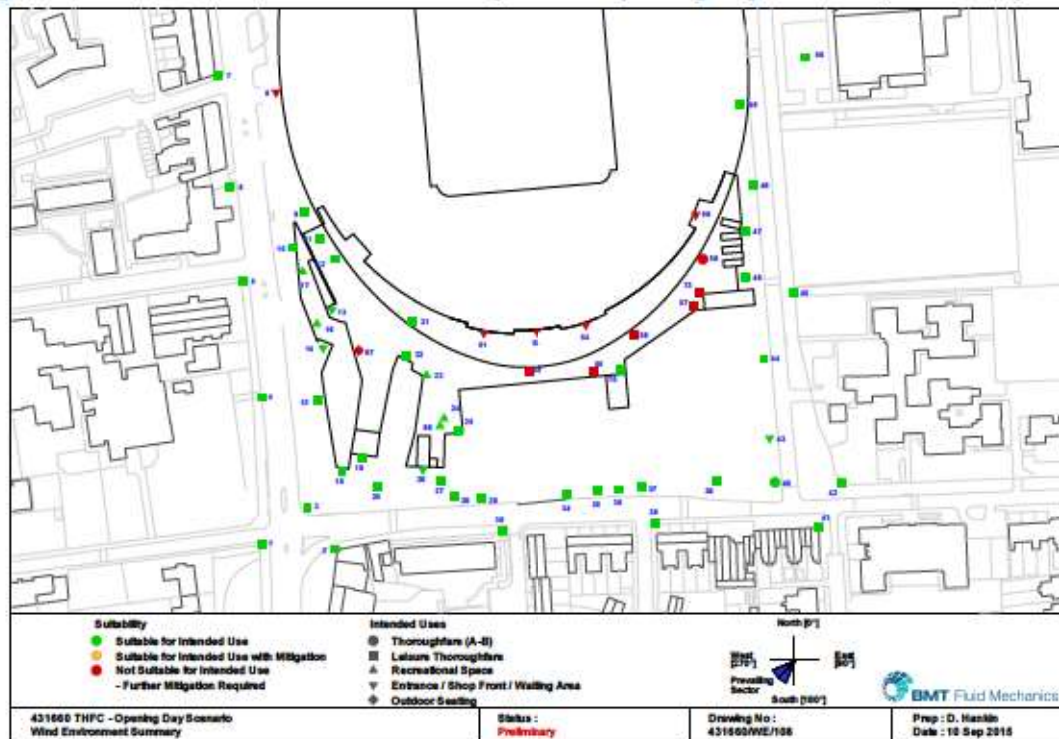
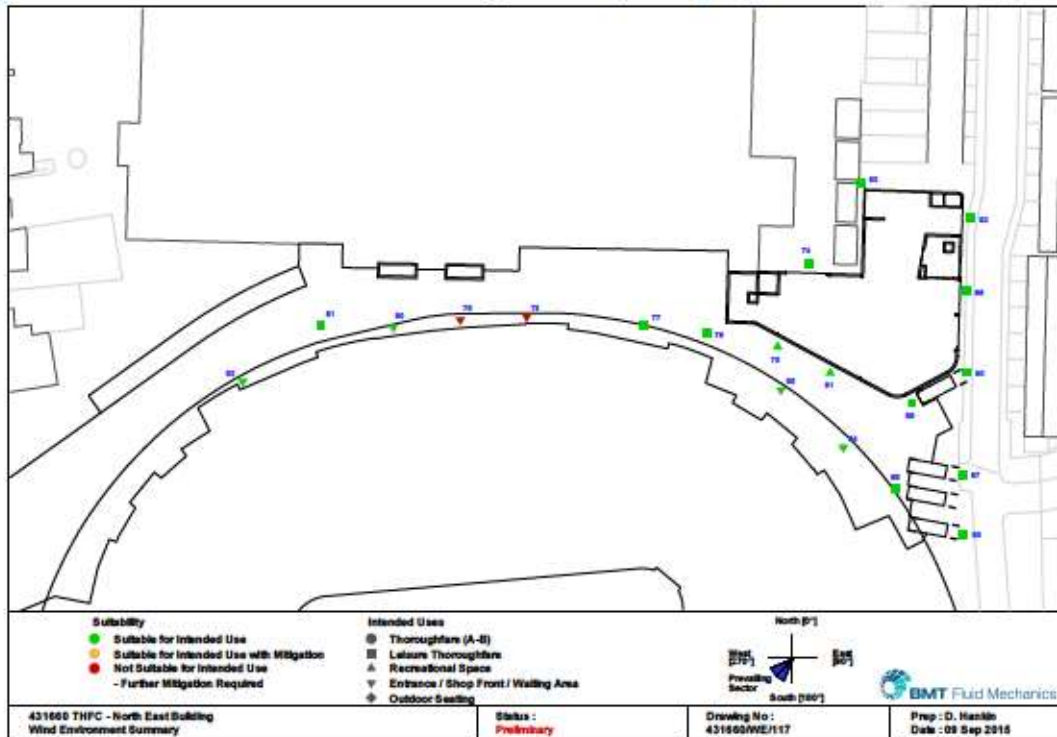


Figure 16.4b: Wind microclimate summary for the opening day scenario, northern podium area



Safety

16.5.6 With the introduction of the initial phase of the Project, namely the opening day scenario, wind conditions are created in some areas that are considered safe for the able bodied, but unsuitable for the general public:

- Around the South-East of the stadium [Locations 54, 56, 58, 59 and 73].
- The effect of the Project on the wind environment at these locations is of **major adverse** significance.

Comfort - Thoroughfares

16.5.7 With the introduction of the initial phase of the Project, wind conditions at leisure thoroughfares in and around the site are generally rated as suitable, in terms of pedestrian comfort, for the intended use, with the exception of those to the South-East of the stadium [Locations 52, 55, 56, 57 and 73] where conditions are at best suitable for pedestrian transit. The latter represents a **moderate adverse** impact. At all other leisure thoroughfares the impact is **negligible**.

16.5.8 For the thoroughfare located to the South-East of the stadium that is intended for pedestrian transit only [Location 58], wind conditions are too windy for comfortable thoroughfare in the absence of mitigation, being rated as uncomfortable for all uses. This represents a **moderate adverse** impact.

Comfort – Entrances

- 16.5.9 With the introduction of the initial phase of the Project, wind conditions at entrances to the proposed stadium are considered unsuitable, in terms of pedestrian comfort, for ingress/egress from the building. This represents a **moderate adverse** impact.
- 16.5.10 Conversely, wind conditions at entrances in and around the remainder of the Project Site are considered suitable, in terms of pedestrian comfort, for ingress/egress from the building. This represents a **negligible** impact.

Comfort – Recreational Spaces

- 16.5.11 With the introduction of the initial phase of the Project, wind conditions at all recreational spaces in and around the site, are considered suitable, in terms of pedestrian comfort, for the intended use throughout the year. This represents a **negligible** impact.

Comfort – Outdoor Seating

- 16.5.12 With the introduction of the initial phase of the Project, wind conditions at the outdoor seating area to the East of the proposed shop are considered unsuitable, in terms of pedestrian comfort, for the intended use being suitable only for short term standing / sitting during summer in the absence of mitigation. This represents a **moderate adverse** impact.

Opening day scenario with soft landscaping and mitigation measures

- 16.5.13 The wind environment has been assessed for the opening day scenario with the inclusion of soft landscaping proposals and wind mitigation measures.
- 16.5.14 The proposed soft landscaping, presented graphically in Figure 16.5, comprised of the following:
- Planter, ~0.5m tall, with ~0.5m hedging and 9 x ~10m trees in South-East area of podium
 - Planter, ~0.5m tall with 2 x ~10m trees in South-East area of podium
 - 2x Planter, ~1m tall, with ~0.5m hedging in North-East area of podium
 - 2x Planter, ~1m tall, with 3x 2.4m trees in North-East area of podium
- 16.5.15 Wind mitigation measures, presented graphically in Figure 16.6, comprised of the following:
- Screen, with a porosity of approximately 50%, and being approximately 2m tall x 1m wide located either side of the entrances along the southern and northern façade of the stadium
 - Solid wall (being approximately 4m tall x 2m wide) located at the western entrance to the stadium
 - Solid signs (being approximately 2m wide x 6m tall) suspended 3m above the podium from the SE Façade of the stadium.
 - Site Hoarding (being approximately 2m high) around construction areas

Figure 16.5: Soft landscaping proposals, opening day scenario

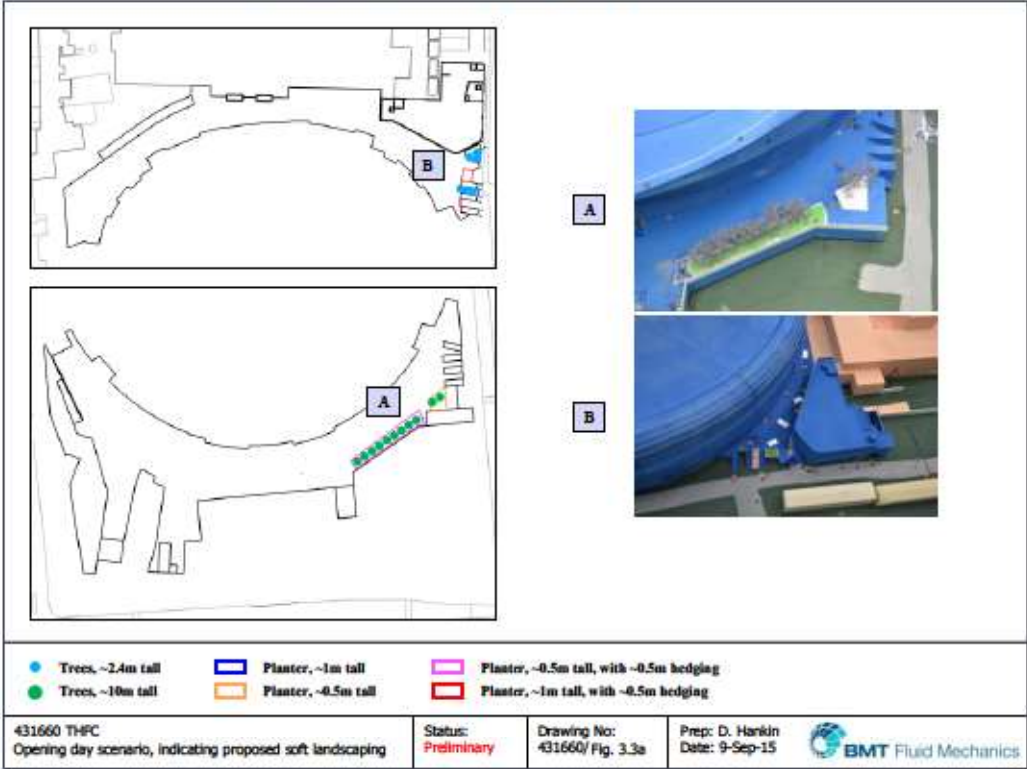


Figure 16.6: Wind mitigation measures, opening day scenario

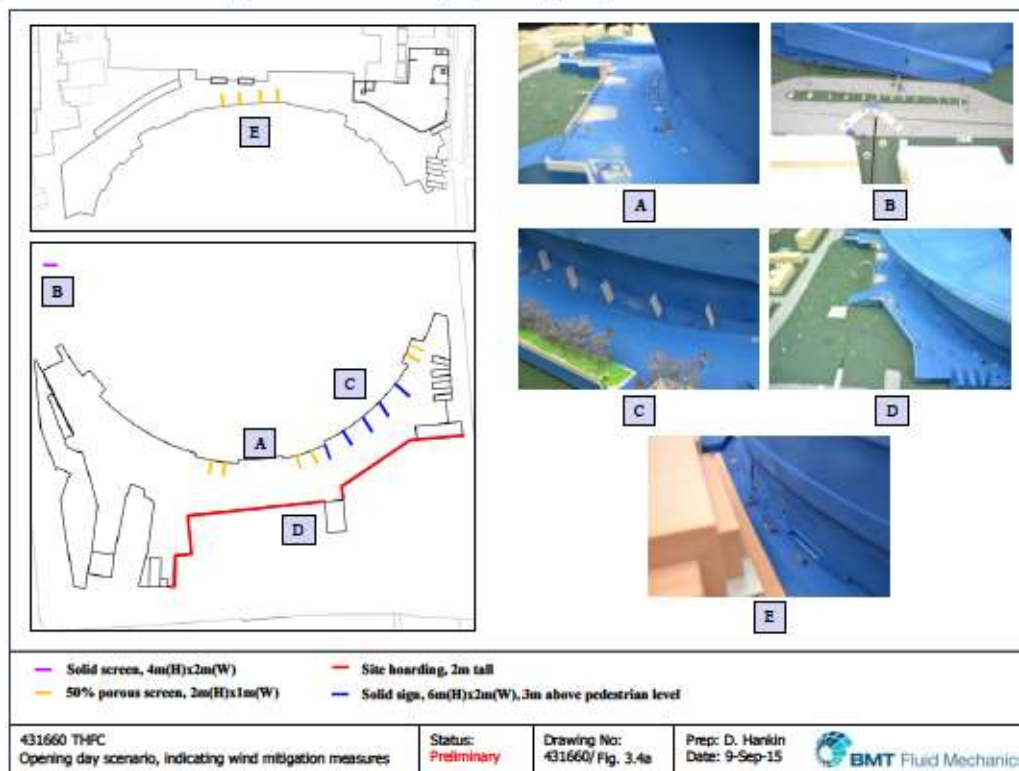


Figure 16.7a: Wind microclimate summary for the opening day scenario with the inclusion of soft landscaping and wind mitigation measures, southern podium area

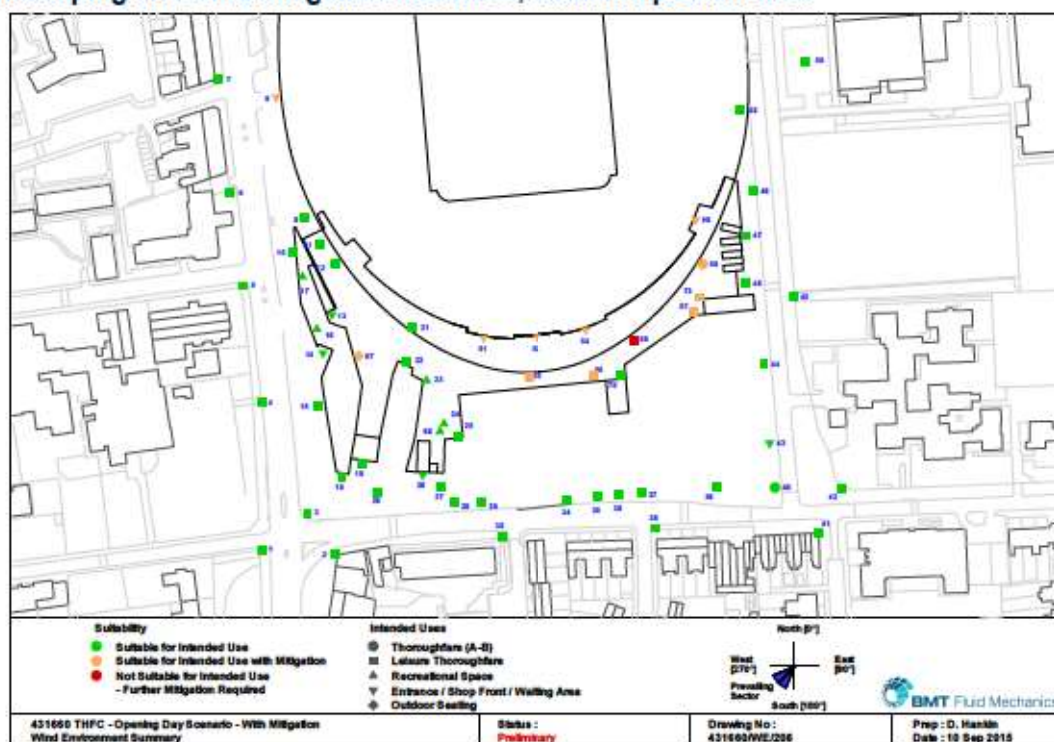
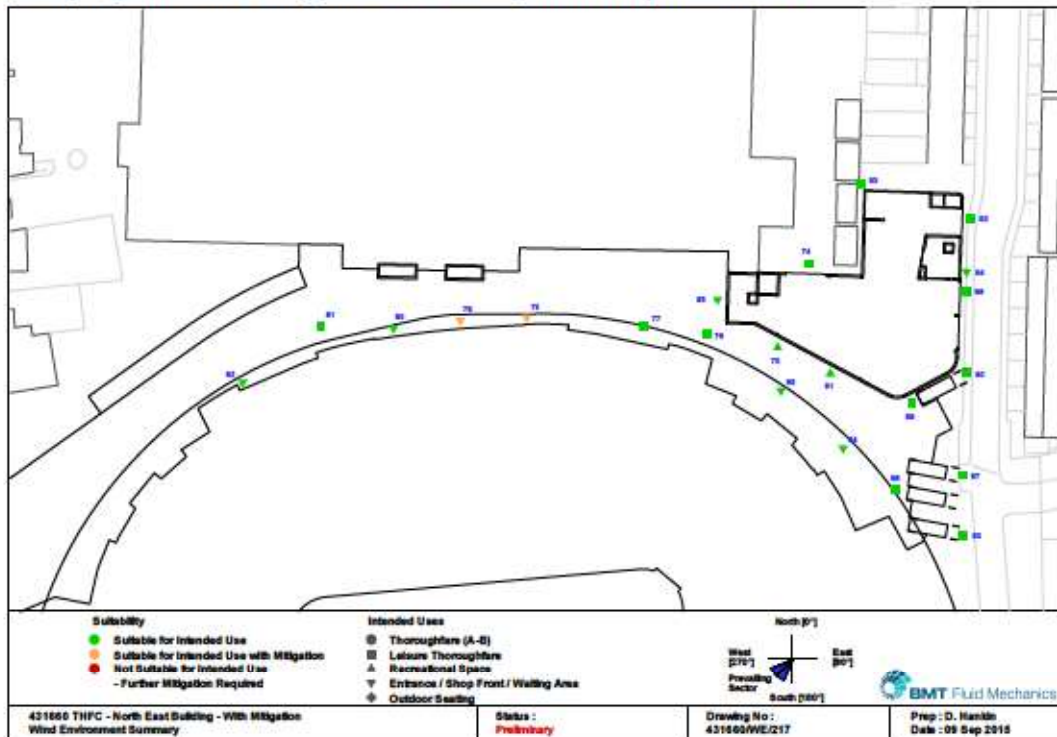


Figure 16.7b: Wind microclimate summary for the opening day scenario with the inclusion of soft landscaping and wind mitigation measures, northern podium area



Safety

- 16.5.16 With the introduction of the proposed soft landscaping and wind mitigation measures to the initial phase of the Project, wind conditions in and around the Project Site are considered suitable, in terms of safety, for use by the general public. This represents a **negligible** residual effect.

Comfort - Thoroughfares

- 16.5.17 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions at the majority of thoroughfares in and around the site remain suitable, or are improved such that they become suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** residual effect.
- 16.5.18 A single exception to this remains to the South-East [Location 56] where conditions are rated as suitable, in terms of pedestrian comfort, for pedestrian transit only during the winter months, but is otherwise rated as suitable for the intended uses as leisure thoroughfare throughout the rest of the year. This represents a **moderate adverse** residual effect.

Comfort – Entrances

- 16.5.19 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions at all entrances in and around the site remain suitable, or are improved such that they become suitable, in terms of pedestrian comfort, for ingress/egress from the buildings. This represents a **negligible** residual

effect.

Comfort - Recreational Spaces

- 16.5.20 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions at all recreational spaces in and around the site, remain suitable, in terms of pedestrian comfort, for the intended use throughout the year. This represents a **negligible** residual effect.

Comfort – Outdoor Seating

- 16.5.21 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions at the outdoor seating area to the East of the proposed shop are improved such that they become suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** residual effect.

Completed Podium (i.e. Stadium, Tottenham Experience, completed Health Centre and completed Podium)

- 16.5.22 The wind environment has been assessed for the completed podium, namely the stadium, shop, completed health centre and completed podium, with the inclusion of soft landscaping proposals and wind mitigation measures.
- 16.5.23 The proposed soft landscaping, presented graphically in Figure 16.8, comprised of the following:
- Planter, ~0.5m tall, with ~0.5m hedging and 9 x ~10m trees in South-East area of podium
 - Planter, ~0.5m tall with 2 x ~10m trees in South-East area of podium
 - 2x Planter, ~1m tall, with ~0.5m hedging in North-East area of podium
 - 2x Planter, ~1m tall, with 3x 2.4m trees in North-East area of podium
 - Stepped Planters, approximately ~1m tall on the southern podium with trees ~10m tall.
- 16.5.24 Wind mitigation measures for the opening day scenario were kept in place, with the position of the hoarding adjusted to correspond with the perimeter of the construction areas.

Figure 16.8: Soft landscaping proposals, construction phases

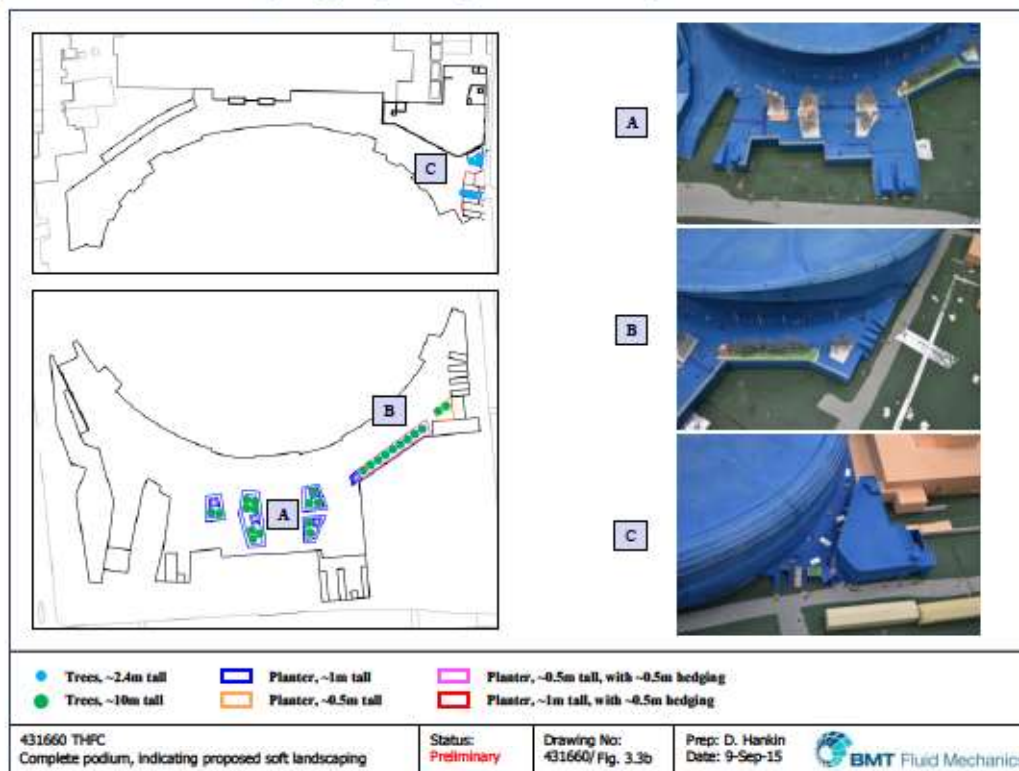


Figure 16.9a: Wind microclimate summary for the completed podium with the inclusion of soft landscaping and wind mitigation measures, southern podium area

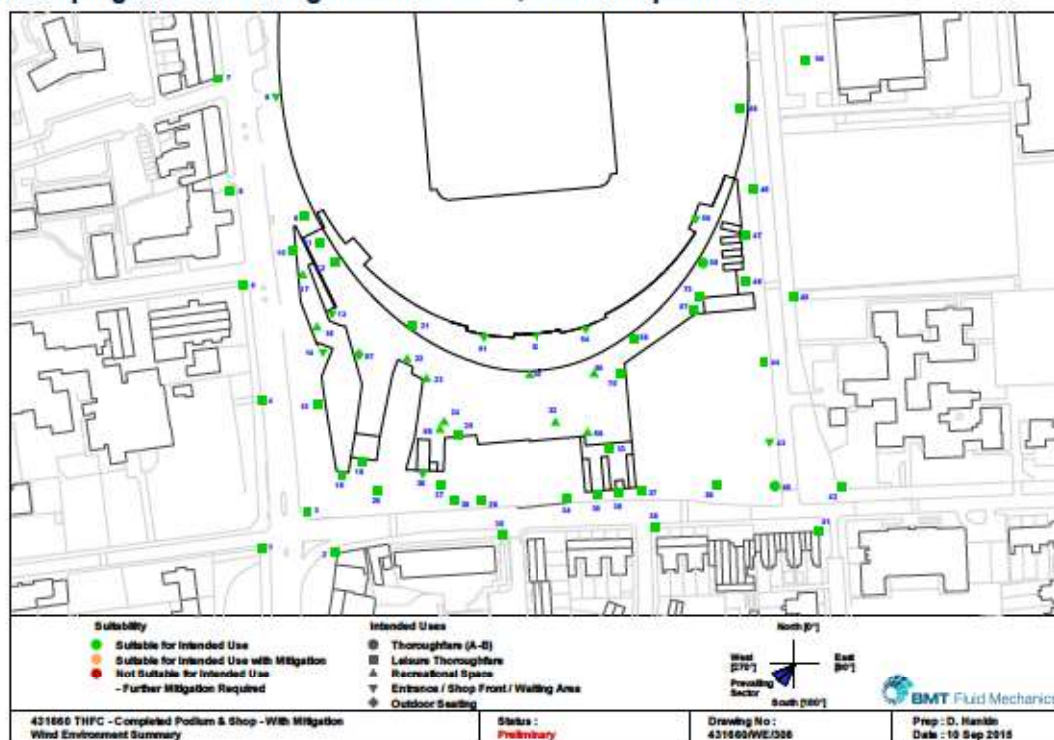
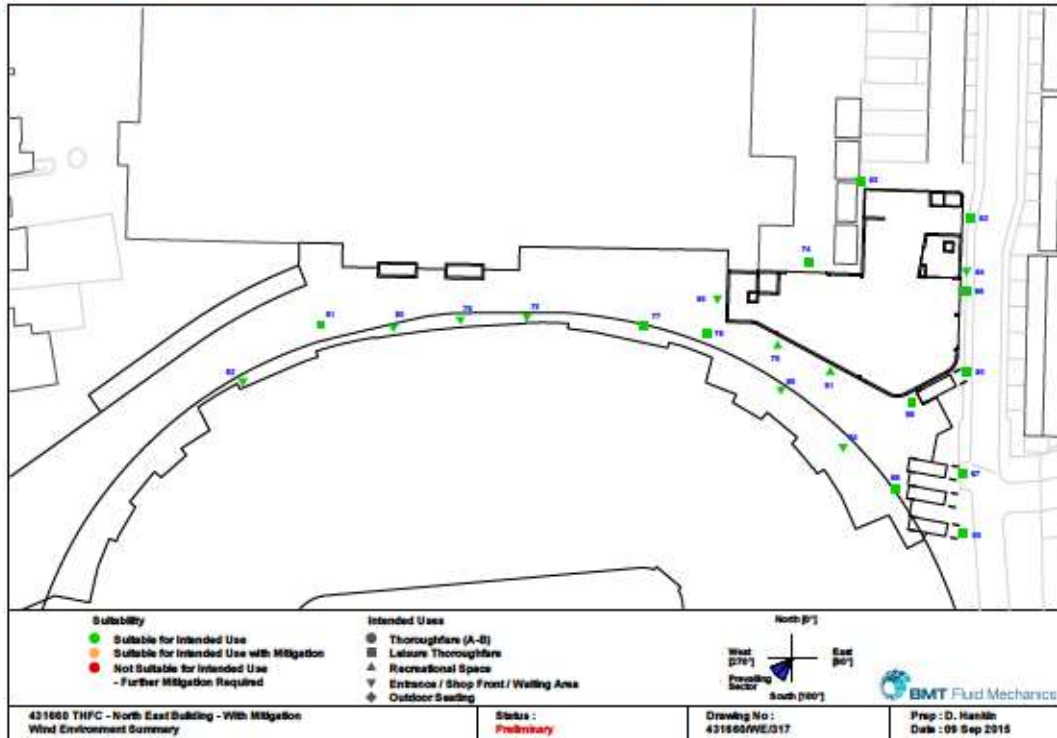


Figure 16.9b: Wind microclimate summary for the completed podium with the inclusion of soft landscaping and wind mitigation measures, northern podium area



Safety

- 16.5.25 With the introduction of the completed podium and additional soft landscaping, wind conditions in and around the Project Site remain suitable, in terms of safety, for use by the general public. This represents a **negligible** impact.

Comfort - Thoroughfares

- 16.5.26 With the introduction of the completed podium and additional soft landscaping, wind conditions at all thoroughfares in and around the site remain suitable, or are improved such that they become suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** impact.

Comfort – Entrances

- 16.5.27 With the introduction of the completed podium and additional soft landscaping, wind conditions at all entrances in and around the site remain suitable, in terms of pedestrian comfort, for ingress/egress from the buildings. This represents a **negligible** impact.

Comfort - Recreational Spaces

- 16.5.28 With the introduction of the completed podium and additional soft landscaping, wind conditions at all recreational spaces in and around the site, remain suitable, in terms of pedestrian comfort, for the intended use throughout the year. This represents a **negligible** impact.

Comfort – Outdoor Seating

- 16.5.29 With the introduction of the completed podium and additional soft landscaping, wind conditions at the outdoor seating area to the East of the proposed shop remain suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** impact.

Completed Hotel (i.e. Stadium, Tottenham Experience, Health Centre, Hotel and Podium)

- 16.5.30 The wind environment has been assessed for the completed hotel, namely the stadium, shop, completed health centre, hotel and completed podium, with the inclusion of soft landscaping proposals and wind mitigation measures as per the completed podium scenario.

Figure 16.10a: Wind microclimate summary for the completed hotel with the inclusion of soft landscaping and wind mitigation measures, southern podium area

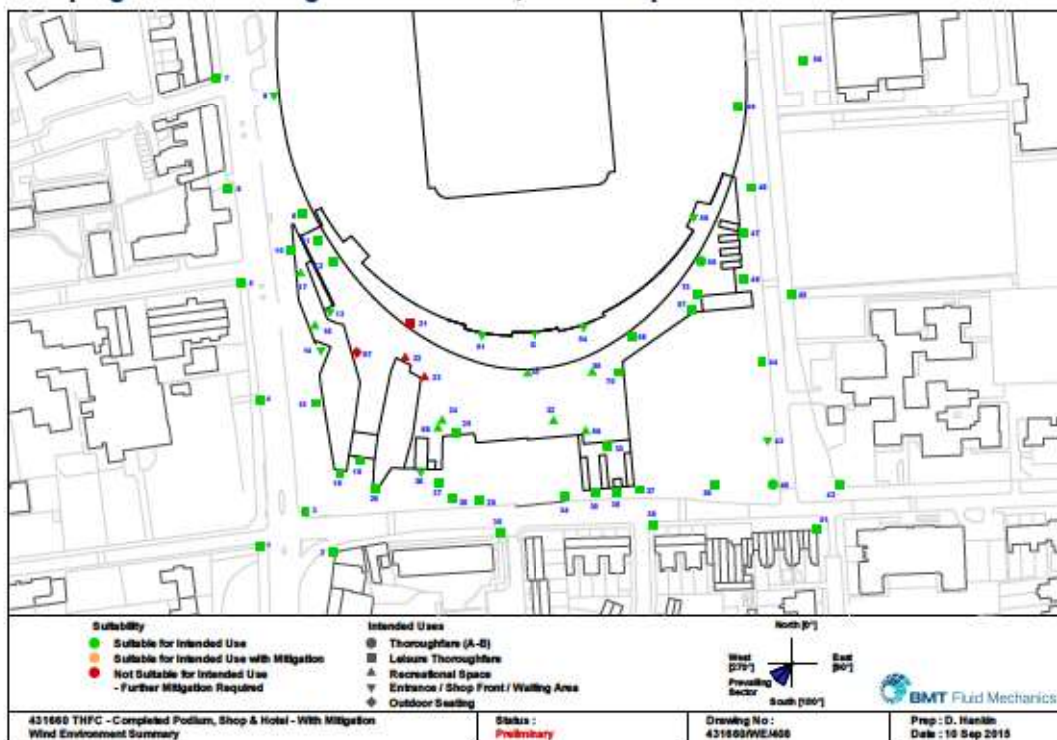
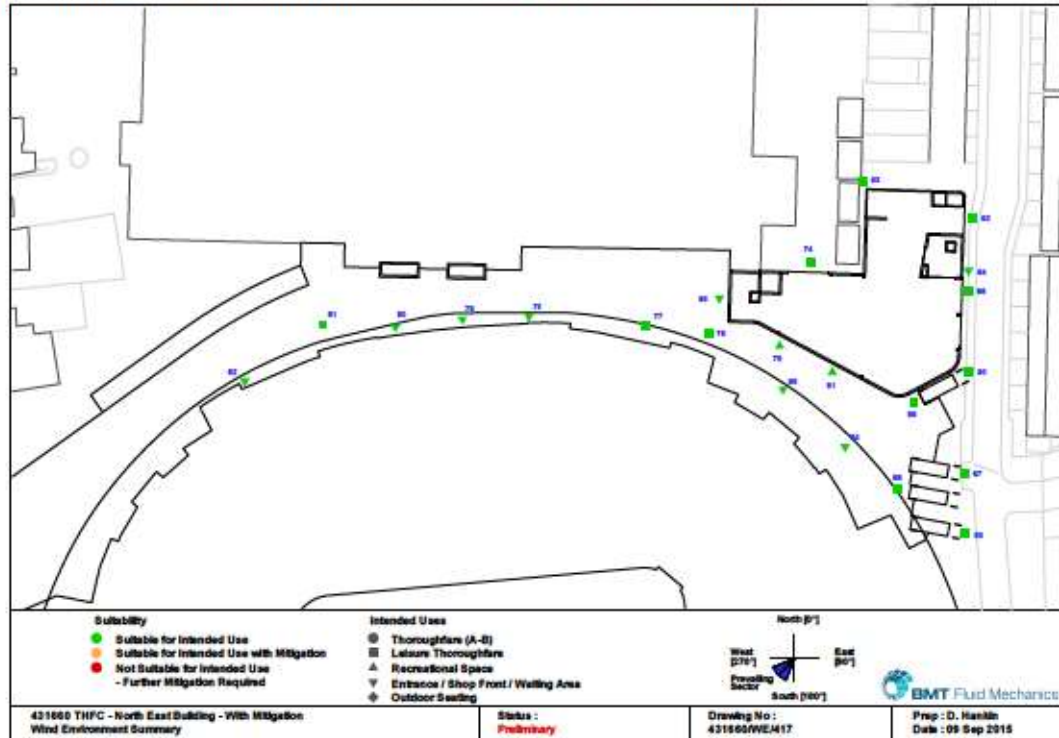


Figure 16.10b: Wind microclimate summary for the completed hotel with the inclusion of soft landscaping and wind mitigation measures, northern podium area



Safety

- 16.5.31 With the introduction of the proposed hotel, wind conditions in and around the Project Site remain suitable, in terms of safety, for use by the general public. This represents a **negligible** impact.

Comfort - Thoroughfares

- 16.5.32 With the introduction of the proposed hotel, wind conditions at the majority of thoroughfares in and around the site remain suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** residual effect.

- 16.5.33 However, windier conditions to the South-West of the stadium result in location 21 becoming suitable for pedestrian transit only during the winter months. Conditions in this area are otherwise rated as suitable for the intended uses as leisure thoroughfare throughout the rest of the year. This represents a **moderate adverse** impact.

Comfort – Entrances

- 16.5.34 With the introduction of the proposed hotel, wind conditions at all entrances in and around the site remain suitable, in terms of pedestrian comfort, for ingress/egress from the buildings. This represents a **negligible** impact.

Comfort - Recreational Spaces

- 16.5.35 With the introduction of the proposed hotel, wind conditions at all recreational spaces in and around the

site, generally remain suitable, in terms of pedestrian comfort, for the intended use throughout the year. This represents a **negligible** impact.

- 16.5.36 However, an exception occurs at the base of the proposed hotel to the North [Locations 22 and 23] where windier conditions prevail. This represents a **moderate adverse** impact.

Comfort – Outdoor Seating

- 16.5.37 With the introduction of the proposed hotel, wind conditions at the outdoor seating area to the East of the proposed shop become unsuitable, in terms of pedestrian comfort, for the intended use, being suitable for short term standing / sitting as opposed to longer term sitting. This represents a **moderate adverse** impact.

Completed Sports Development (i.e. Stadium, Tottenham Experience, Health Centre, Hotel, Sports Development and Podium)

- 16.5.38 The wind environment has been assessed for the completed hotel, namely the stadium, shop, completed health centre, hotel, sports development and completed podium, with the inclusion of soft landscaping proposals and wind mitigation measures as per the completed podium scenario.

Figure 16.11a: Wind microclimate summary for the completed sports development with the inclusion of soft landscaping and wind mitigation measures, southern podium area

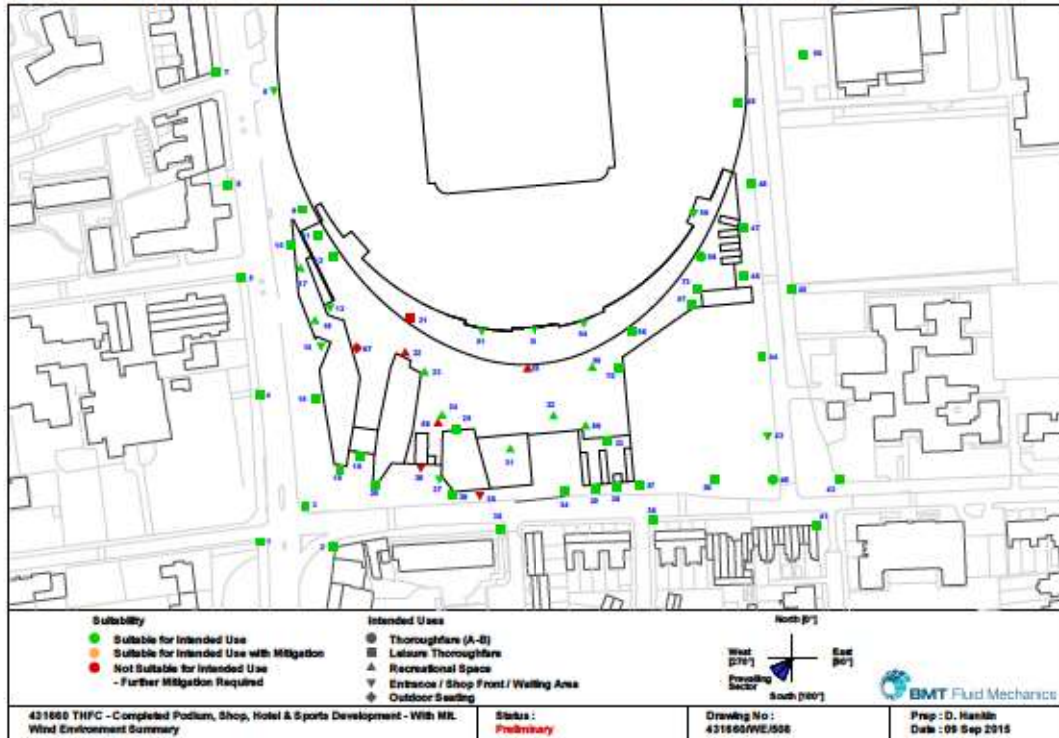
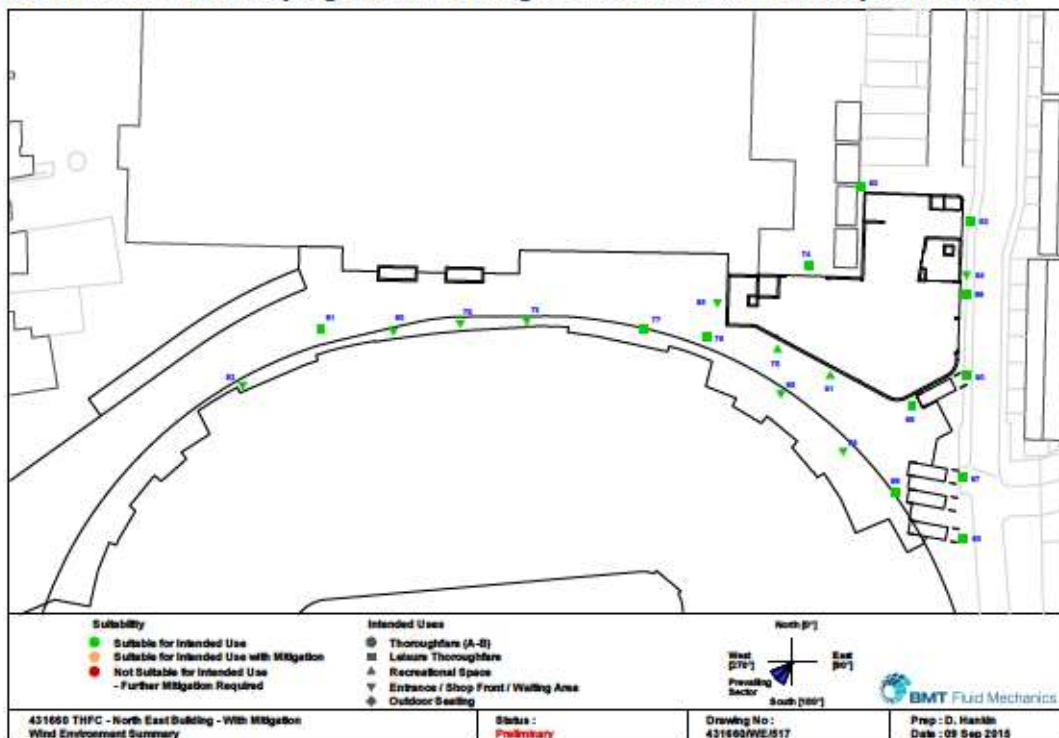


Figure 16.11b: Wind microclimate summary for the completed sports development with the inclusion of soft landscaping and wind mitigation measures, northern podium area



Safety

- 16.5.39 With the introduction of the proposed sports development, wind conditions in and around the Project Site remain suitable, in terms of safety, for use by the general public. This represents a **negligible** impact.

Comfort - Thoroughfares

- 16.5.40 With the introduction of the proposed sports development, wind conditions at the majority of thoroughfares in and around the site remain suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** residual effect.

- 16.5.41 However, windier conditions to the South-West of the stadium at location 21 remain suitable for pedestrian transit only during the winter months. Conditions in this area are otherwise rated as suitable for the intended uses as leisure thoroughfare throughout the rest of the year. This represents a **moderate adverse** impact.

Comfort – Entrances

- 16.5.42 With the introduction of the proposed sports development, wind conditions at the majority entrances in and around the site remain suitable, in terms of pedestrian comfort, for ingress/egress from the buildings. This represents a **negligible** impact.
- 16.5.43 However, the entrances to the East of the hotel [Locations 26 and 29] become unsuitable, in terms of pedestrian comfort, for ingress/egress from the building. This represents a **moderate adverse** impact.

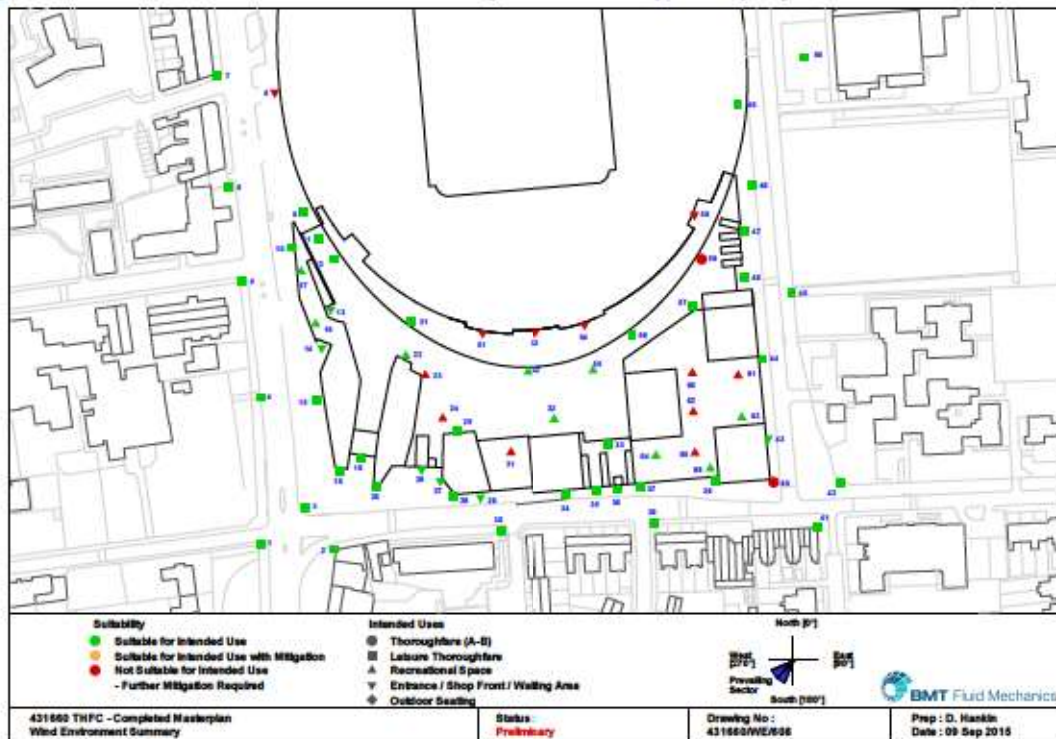
Comfort - Recreational Spaces

- 16.5.44 With the introduction of the proposed sports development, wind conditions at all recreational spaces in and around the site, generally remain suitable, in terms of pedestrian comfort, for the intended use throughout the year. This represents a **negligible** impact.
- 16.5.45 However, whilst wind conditions at location 23 become suitable, in terms of pedestrian comfort, for the intended use, wind conditions to the East of the hotel [Location 68] and in the central podium area [Location 52] become unsuitable and to the North of the hotel [Location 22] remains unsuitable. This represents a **moderate adverse** impact.

Comfort – Outdoor Seating

- 16.5.46 With the introduction of the proposed sports development, wind conditions at the outdoor seating area to the East of the proposed shop remain unsuitable, in terms of pedestrian comfort, for the intended use. This represents a **moderate adverse** impact.
- 16.5.47 Complete Project (i.e Stadium, Tottenham Experience, Hotel, Extreme Sports Centre, Residential Towers, and Health Centre)
- 16.5.48 Full details of the suitability assessment for the completed Project, namely the stadium, shop, hotel, sports and residential developments, without soft landscaping and wind mitigation measures and with existing surrounding buildings are presented in graphical format in Figure 16.12.

Figure 16.12: Wind microclimate summary for the completed project



Safety

16.5.49 With the introduction of the completed project, wind conditions are created in some areas that are considered safe for the able bodied, but unsuitable for the general public:

- Around the South-East of the stadium [Location 58];
- Between the residential towers [Location 62];
- Around the South-East corner of the residential development [Location 40].
- The effect of the Project on the wind environment at these locations is of **major adverse** significance.

Comfort - Thoroughfares

16.5.50 With the introduction of the completed project, wind conditions at all thoroughfares in and around the site are considered suitable, in terms of pedestrian comfort, for the intended use as either leisurely strolling or pedestrian transit where appropriate. This represents a **negligible** impact.

Comfort – Entrances

16.5.51 With the introduction of the completed project, wind conditions at entrances to the stadium are considered unsuitable, in terms of pedestrian comfort, for ingress/egress from the building in the absence of wind mitigation measures. This represents a **moderate adverse** impact.

16.5.52 Conversely, wind conditions at entrances in and around the remainder of the Project are considered suitable, in terms of pedestrian comfort, for ingress/egress from the building. This represents a **negligible**

impact.

Comfort - Recreational Spaces

- 16.5.53 With the introduction of the completed project, wind conditions at recreational spaces in and around the podium area are generally considered suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** impact
- 16.5.54 Exceptions to this occur between the hotel and sports development [Locations 23 and 24], on the podium of the sports development [Location 31] where windier conditions prevail. This represents a **moderate adverse** impact.
- 16.5.55 However, wind conditions at recreational spaces within the residential development are largely unsuitable, in terms of pedestrian comfort, for the intended use in the absence of mitigation measures. This represents a **moderate adverse** impact.
- 16.5.56 Exceptions to this occur at the southern extent of the podium [Locations 64 & 66] and the base of the south-eastern tower [Location 63] where conditions are rated as suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** impact.

Complete Project with soft landscaping and wind mitigation measures

- 16.5.57 The wind environment has been assessed for the completed project with the inclusion of soft landscaping proposals and wind mitigation measures.
- 16.5.58 The proposed soft landscaping, presented graphically in Figure 16.8, comprised of the following:
- Trees (~5m tall) around the residential area and the sport development
 - Trees (~10m tall) around the Project Site
- 16.5.59 Wind mitigation measures, presented graphically in Figure 16.9, comprised of the following:
- Tree (~1.8m tall) on the North-West corner of the South-East residential tower
 - Hedge (~1m tall) along the North of the sport development
 - Hedges (~1.6m tall) around the tops of the atriums, at the base of and on the roof terraces of residential developments and on the podium of the sport development
 - Parapets (~1.6m tall) on roof terraces of residential developments
 - Parapets (~1.2m tall) on podium of sport development
 - Screen, with a porosity of approximately 50%, and being approximately 2m tall x 1m wide along the southern façade of the stadium
 - Solid wall (being 4m tall x 2m wide) located at the western entrance to the stadium

Figure 16.13: Soft landscaping proposals, completed project

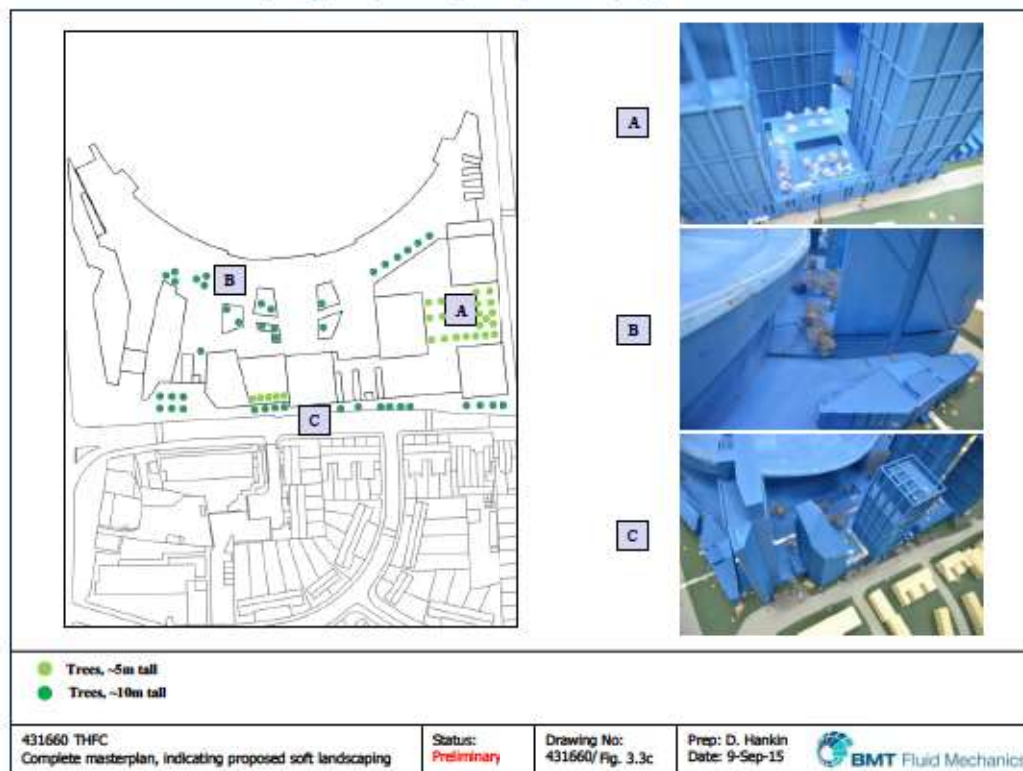


Figure 16.14: Wind mitigation measures, completed project

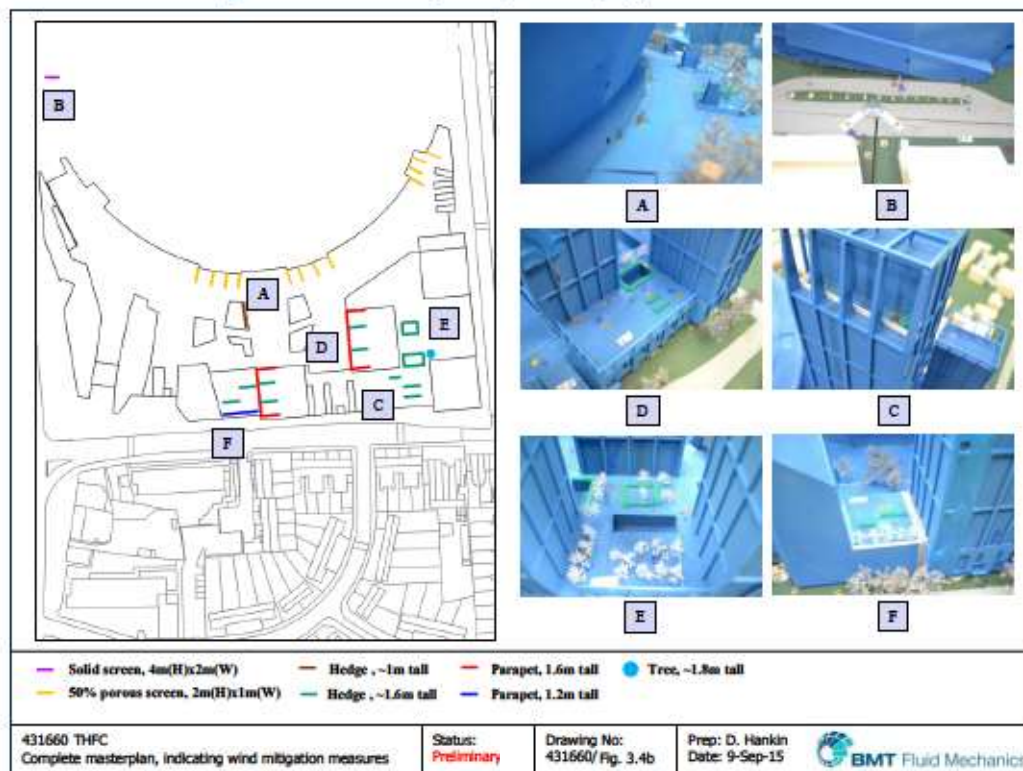
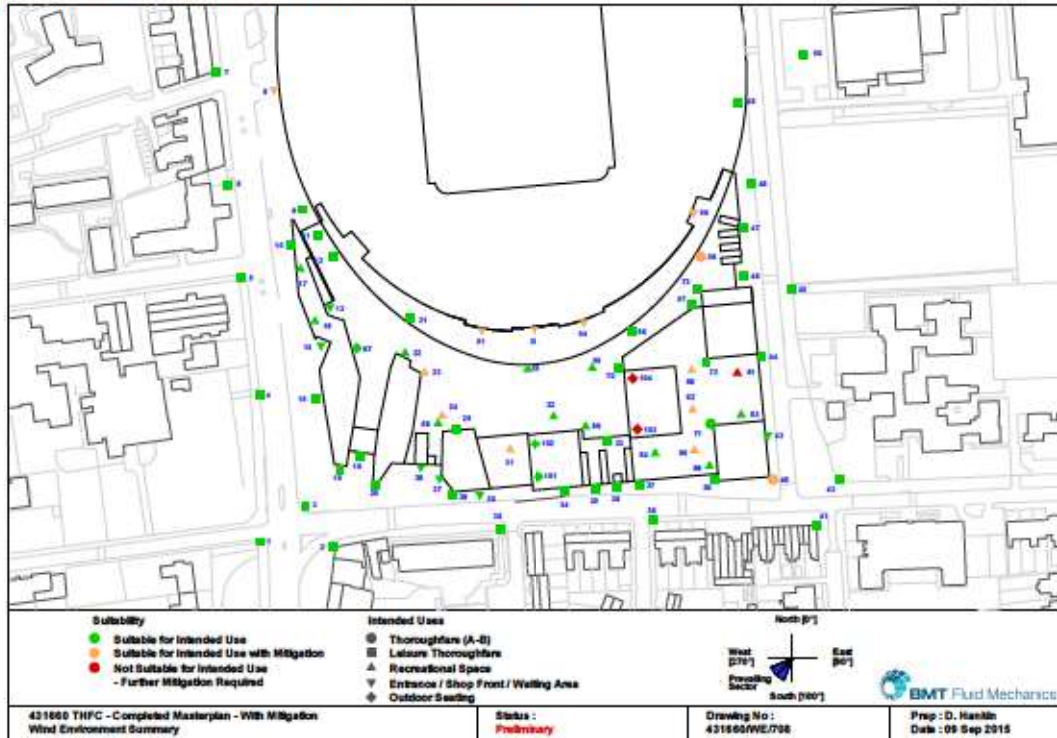


Figure 16.15: Wind microclimate summary for the completed project with the inclusion of soft landscaping and wind mitigation measures



Safety

- 16.5.60 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions in and around the Project Site are considered suitable, in terms of safety, for use by the general public. This represents a **negligible** residual effect.

Comfort - Thoroughfares

- 16.5.61 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions at all thoroughfares in and around the site are considered suitable, in terms of pedestrian comfort, for the intended use as either leisurely strolling or pedestrian transit where appropriate. This represents a **negligible** residual effect.

Comfort – Entrances

- 16.5.62 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions at all entrances in and around the site are considered suitable, in terms of pedestrian comfort, for ingress/egress from the building. This represents a **negligible** residual effect.

Comfort – Recreational Spaces

- 16.5.63 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions at the majority of recreational spaces in and around the site are considered suitable, in terms of pedestrian comfort, for the intended use. A single exception to this remains between the residential towers [Location 61] where windier conditions prevail, this represents a **moderate adverse** residual effect. At all other recreational spaces the residual effect is **negligible**.

Comfort – Outdoor Seating

- 16.5.64 With the introduction of the proposed soft landscaping and wind mitigation measures, wind conditions at the outdoor seating area to the East of the proposed shop are considered suitable, in terms of pedestrian comfort, for the intended use. This represents a **negligible** residual effect.

Comfort – Balconies

- 16.5.65 Wind conditions within balcony areas are considered suitable, in terms of pedestrian comfort, for the intended use as outdoor seating, with the exception of the balconies at the top of the tallest tower of the residential development [Locations 103 and 104] where wind conditions are suitable for outdoor viewing only, this represents a **moderate adverse** residual effect. At all other balcony areas the residual effect is **negligible**.

16.6 Assessment Summary and Residual Environmental Impacts and Effects

Construction

- 16.6.1 During the demolition and construction works, given the dusty and untidy conditions typical of a construction site, pedestrians moving within the area would have lowered expectations, in terms of wind comfort, than otherwise might be expected. As such, this is considered to be a **negligible to minor adverse** residual effect.

Operation

- 16.6.2 With the proposed soft landscaping scheme and wind mitigation measures, the residual effect on wind microclimate at the majority of locations in and around the Project Site is expected to be **negligible**, which implies that the wind microclimate would be suitable for the intended use. However, windier conditions persist at some locations representing a residual effect that is **moderate adverse**, which implies that there are outstanding comfort issues in these areas. A summary of the residual effects is provided in Table 16.4.

Table 16.4: Microclimate Residual Effects

Environmental Effect	Sensitivity of Receptor	Nature of Impact	Impact Magnitude	Significance	Additional Mitigation	Residual impact Magnitude	Residual Significance of Effect
Construction Effects							
Wind effect on construction site	Medium	Negligible	Neutral	Neutral	None	Negligible	Neutral
Operational Effects – Opening Day Scenario							
Exceedance of safety criteria	High	Negative	High	Major	landscaping, screens/signs & hoarding	Negligible	Neutral
Wind effect on thoroughfares	High	Negative	Medium	Moderate	landscaping, screens/signs & hoarding	Low	Moderate
Wind effect on entrances	High	Negative	Medium	Moderate	side screens	Negligible	Neutral
Wind effect on recreational spaces	High	Negligible	Neutral	Neutral	None	Negligible	Neutral
Wind effect on outdoor seating	High	Negative	Medium	Moderate	hoarding	Negligible	Neutral
Operational Effects – Completed Podium							
Exceedance of safety criteria	High	Negligible	-	-	As per Opening Day Scenario with the addition of further landscaping to the southern podium area	Negligible	Neutral
Wind effect on thoroughfares	High	Negligible	-	-		Negligible	Neutral
Wind effect on entrances	High	Negligible	-	-		Negligible	Neutral
Wind effect on recreational spaces	High	Negligible	-	-		Negligible	Neutral
Wind effect on outdoor seating	High	Negligible	-	-		Negligible	Neutral
Operational Effects – Completed Hotel							
Exceedance of safety criteria	High	Negligible	-	-	As per Completed Podium	Negligible	Neutral
Wind effect on thoroughfares	High	Negative	-	-		Low	Moderate
Wind effect on entrances	High	Negligible	-	-		Negligible	Neutral
Wind effect on recreational spaces	High	Negative	-	-		Low	Moderate
Wind effect on outdoor seating	High	Negative	-	-		Medium	Moderate
Operational Effects – Completed Sports Development							
Exceedance of safety criteria	High	Negligible	-	-	As per Completed Podium	Negligible	Neutral
Wind effect on thoroughfares	High	Negative	-	-		Low	Moderate
Wind effect on	High	Negative	-	-		Low	Moderate

entrances							
Wind effect on recreational spaces	High	Negative	-	-		Low	Moderate
Wind effect on outdoor seating	High	Negative	-	-		Medium	Moderate
Operational Effects – Completed Project							
Exceedance of safety criteria	High	Negative	High	Major	Landscaping & screens	Negligible	Neutral
Wind effect on thoroughfares	High	Negligible	Neutral	Neutral	None	Negligible	Neutral
Wind effect on entrances	High	Negative	Medium	Moderate	side screens	Negligible	Neutral
Wind effect on recreational spaces	High	Negative	Medium	Moderate	Landscaping & balustrades	Low	Moderate
Wind effect on outdoor seating	High	Negligible	-	-	None	Negligible	Neutral
Wind effect on balconies	High	Negative	-	-	Landscaping & parapets	Low	Moderate

17. Daylight, Sunlight and Overshadowing

17.1 Introduction

- 17.1.1 This chapter of the Environmental Statement (ES) assesses the likely significant environmental effects of the Project in terms of daylight, sunlight, overshadowing, light pollution and solar glare.
- 17.1.2 The technical analysis has been undertaken in accordance with the Building Research Establishment (BRE) Guidelines 'Site Layout Planning for Daylight and Sunlight 2011: A Guide to Good Practice' (2011) criteria⁵³.
- 17.1.3 This chapter outlines the relevant policy context, describes the methodologies applied, the baseline conditions at the site and its surrounds and the potential effects associated with the Project. Where appropriate, mitigation is set out as necessary and the resulting likely residual effects are also identified.
- 17.1.4 This chapter considers the potential for cumulative daylight, sunlight, overshadowing, light pollution and solar glare effects (Type 2 effects) of the Project in combination with other development schemes. The potential for daylight, sunlight, overshadowing, light pollution and solar glare effect interactions and combined effects (Type 1 effects) are discussed in this Statement.
- 17.1.5 An assessment of the daylight and sunlight within the proposed residential blocks (as outline) are included within this Environmental Statement in Appendix 17.2.
- 17.1.6 This assessment and ES chapter has been produced by GIA and is supported by the following technical Appendices within Volume 3 (Technical Appendices):
- Appendix 17.1: Drawings of baseline, proposed and cumulative scenarios;
 - Appendix 17.2: Detailed Analysis Results Of The Levels Of Daylight And Sunlight Amenity Within Residential Properties and Schools surrounding the Site for all scenarios;
 - Appendix 17.3: Overshadowing results;
 - Appendix 17.4: Solar Glare assessment; and
 - Appendix 17.5: Daylight Potential Assessment.

17.2 Assessment Criteria and Methodology

- 17.2.1 The following sections of this ES Chapter provide a review of relevant legislation, guidance and national, regional and local planning policy requirements in terms of daylight, sunlight, sun on ground, light pollution and solar glare.

Previous Assessment

- 17.2.2 Whilst an assessment was carried out for the 2010 scheme and subsequent amendments it is considered that the changes are a magnitude that a new assessment is required.

⁵³ Buildings Research Establishment (BRE) (2011); BRE Handbook 'Site Layout Planning for Daylight and Sunlight' a guide for good practice.

Legislative Context

- 17.2.3 The following sections of this ES chapter provide a review of relevant legislation, guidance and national and local planning policy requirements in terms of daylight, sunlight, sun on the ground, light pollution and solar glare.

National Legislation

Environmental Protection Act, Section 79 (1990)

- 17.2.4 Section 79 of the Environmental Protection Act, 1990⁵⁴ as amended by the Clean Neighbourhoods and Environment Act 2005, states the following with regards to light pollution:
- 17.2.5 "Artificial light emitted from premises so as to be prejudicial to health and nuisance constitutes a 'Statutory Nuisance' and it shall be the duty of every local authority to cause its area to be inspected from time to time to detect any statutory nuisances which ought to be dealt with under section 80 [or sections 80 and 80A) and, where a complaint of a statutory nuisance is made to it by a person living within its area, to take such steps as are reasonably practicable to investigate the complaint".

Planning Policy and Guidance

National Planning Policy

National Planning Policy Framework (2012)

- 17.2.6 The National Planning Policy Framework⁵⁵ adopted on the 27th March 2012 stipulates that "...planning policies and decisions should always seek to secure a good standard of amenity for existing and future occupants of land and buildings."

Planning Practice Guidance (2014)

- 17.2.7 Launched last year the national Planning Practice Guidance⁵⁶ does not include any further provisions in terms of daylight, sunlight, overshadowing, light pollution and glare, beyond that stated for the NPPF.

Regional Planning Policy

The London Plan – Spatial Development Strategy for Greater London (2015)

- 17.2.8 The key policies from the adopted London Plan of relevance to this assessment are detailed below⁵⁷:
- 17.2.9 Policy 7.6 states: "...buildings and structures should...not cause unacceptable harm to the amenity of surrounding land and buildings, particularly residential buildings, in relation to privacy, overshadowing, wind and micro-climate."
- 17.2.10 Policy 7.7 notes that large buildings should not adversely affect their surroundings in terms of overshadowing and solar reflected glare: "Location and design of tall buildings should not affect their surroundings adversely in terms of microclimate, wind turbulence, overshadowing, noise, reflected glare, aviation, navigation and telecommunication interference."

⁵⁴ Statutory Office (1990) Environmental Protection Act, Section 79, 1990

⁵⁵ National Planning Policy Framework, 2012

⁵⁶ Planning Practice Guidance (2014)

⁵⁷ Greater London Authority (2015); The London Plan: Spatial Development Strategy of Greater London.

Interim Strategic Planning Guidance on Tall Buildings, Strategic Views and the Skyline in London (October 2001)

17.2.11 This interim guidance⁵⁸ provides guidance in regards to tall buildings within London. It states that there are positive benefits to tall buildings in regards to safeguarding and enhancing London's world city role. Within this guidance it states:

- "the issue of tall office buildings is first and foremost not one of economic need, but an issue of image, aesthetics, local public transport and servicing capacity"
- "Outside the City there are unlikely to be many opportunities for very tall office blocks in the West End, given the City of Westminster Council's opposition to tall buildings in most locations. Tall buildings of up to 100 metres might be possible at a few locations such as Paddington, but even at Victoria opportunities are limited."
- "It is no longer possible to provide sufficiently large buildings in the City in the form of low groundscrappers, even if that is what potential occupiers want. What they do want is quality buildings that can give them a sense of identity."
- "The value of clusters of tall buildings from an urban design point of view has been widely recognised."

Local Planning Policy

Haringey Development Management DPD 2013

17.2.12 The key policy from the adopted Development Management DPD for Haringey⁵⁹ of relevance to this assessment is Policy DM2. It states that "development proposals should ensure appropriate levels of daylight and sunlight relevant to their function."

17.2.13 It continues to note that "for example, a kitchen does not need to be naturally daylight or naturally sunlit but workspace need daylight for most types of work and it is important for healthy work life."

17.2.14 It also states that "the default expectation should be that external amenity space (whether that is private, private communal, or communal recreation space) should as the BRE Guide recommends receive at least some sunlight every day for all but the darkest three months of the year."

Other Relevant Policy, Standards and Guidance

English Heritage / Commission for Architecture and the Built Environment Guidance on Tall Buildings (2007)

17.2.15 Paragraph 4.1.8 of the English Heritage (EH) / Commission for Architecture and the Built Environment (CABE) Guidance on Tall Buildings⁶⁰ recommends that the following criteria should be addressed in relation to new developments:

17.2.16 "The effect on the local environment, including microclimate, overshadowing, night-time appearance,

⁵⁸ Greater London Authority (2001) Interim Strategic Planning guidance on tall buildings, strategic views and the Skyline in London

⁵⁹ Haringey (2013) Development Management DPD

⁶⁰ Commission for Architecture and the Built Environment (CABE) (2007); Guidance on Tall Buildings.

vehicle movements and the environment and amenity of those in the vicinity of the building”.

Building Research Establishment (BRE) Guidelines: Site Layout Planning for Daylight and Sunlight 2011, A Guide to Good Practice, Second Edition (2011)

17.2.17 The Building Research Establishment (BRE) Guidelines ‘Site Layout Planning for Daylight and Sunlight – A Guide to Good Practice 2011, 2nd edition’ (released October 2011)⁶¹ provides advice on site layout planning to achieve good sunlighting and daylighting within buildings, and in the open spaces between them. It is intended for use by building designers, developers, consultants and Local Planning Authorities (LPAs). The advice it gives is not mandatory and should not be used as an instrument of planning policy, it states:

17.2.18 “This guide is a comprehensive revision of the 1991 edition of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice. It is purely advisory and the numerical target values within it may be varied to meet the needs of the development and its location.”

17.2.19 It also states:

“The advice is given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. In special circumstances the developer or planning authority may wish to use different target values... in an area with modern high rise buildings, a higher degree of obstruction maybe unavoidable if new developments are to match the height and proportions of existing building” (para.1.6).

17.2.20 In addition, the BRE Guidelines state (para. 1.3) that “it is intended to be read in conjunction with the interior daylighting recommendations in the British Standard 8206-2 Code of practice for daylighting, and in the CIBSE publication Lighting guide: daylighting and window design”.

British Standard (BS) 8206 Part 2 (2008)

17.2.21 The British Standard 8206 part 2⁶¹ provides recommendations regarding the design for daylight in buildings and sets out various methods for assessing daylight. The document states:

“Daylighting gives to a building a unique variety and interest. An interior which looks gloomy, or which does not have a view to the outside when this could reasonably be expected, will be considered unsatisfactory by its users.”

17.2.22 Applications Manual Window Design of the Chartered Institute of Building Services Engineers (CIBSE) (1987)

17.2.23 This guide⁶² replaces the CIBSE Applications Manual Window Design (1987) and provides a daylight design guide. It states:

“when daylighting decisions are made, however, they will have implications for other, interrelated aspects of window performance such as solar heat gain, winter heat loss, provision of view, acoustic performance,

⁶¹ British Standards Institution (BSI) (2008); BS8206-2: 2008 Lighting for buildings; Code of Practice for Daylighting. BSI.

⁶² Chartered Institution of Building Service Engineers (CIBSE) (1999); Applications Manual: Window Design of the Chartered Institute of Building Services Engineers.

privacy, security and protection from fire."

Commission Internationale de L'Eclairage (CIE) 146:2002 & CIE 147:2002 Collection on glare (2002)

17.2.24 The CIE 146:2002⁶³ Collection on glare states:

"Disability glare is glare that impairs vision (CIE, 1987). It is caused by scattering of light inside the eye [...]. The veiling luminance of scattered light will have a significant effect on visibility when intense light sources are present in the peripheral visual field and the contrast of objects to be seen is low."

"Disability glare is most often of importance at night when contrast sensitivity is low and there may well be one or more bright light sources near to the line of sight, such as car headlights, streetlights or floodlights. But even in daylight conditions disability glare may be of practical significance: think of traffic lights when the sun is close to them, or the difficulty viewing paintings hanging next to windows."

Institute of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light GN01:2011(2011)

17.2.25 The ILP document entitled "Guidance Notes for the Reduction of Obtrusive Light"⁶⁴ provides quantitative criteria for acceptable levels of light pollution and distinguishes between rural and dense urban areas.

Assessment Methodology

Methodology for Determining Baseline Conditions and Sensitive Receptors

17.2.26 The BRE Guidelines suggest that residential properties have the highest requirement for daylight and sunlight and states that

"the guidelines are intended for use for rooms in adjoining dwellings where light is required, including living rooms, kitchens and bedrooms".

17.2.27 The following residential properties have been considered due to their proximity to the site and are highlighted in green on Figure 17.1.

- 3-57 Northumberland Park (odd)
- Burleigh Court
- 19 Bennets Close
- 9-13 Bennets Close
- 50 Northumberland Park
- 52 Northumberland Park
- 2-18 Worcester Avenue (even)
- 1-41 Worcester Avenue (odd)
- Northumberland Park Community School/ Sports Centre/ Resource Base
- St Paul's and All Hallows Infant School
- 28-56 Park Lane (even)

⁶³ Commission Internationale de L'Eclairage: guidance notes for the reduction of obtrusive light (2005)

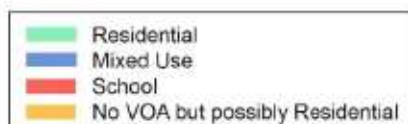
⁶⁴ Institute of Lighting Professionals (2011) Guidance notes for the reduction of obtrusive light

- 1 Lancaster Close
- 2 Lancaster Close
- 3 Lancaster Close
- Concord House
- 2/2a Park Lane
- 2 Vicarage Road
- 28 Bromley Road
- 29 Bromley Road
- 38 Bromley Road
- Coombes House
- 705 High Road
- St Francis De Sales Primary School
- 729 High Road
- 4-18 Bereton Road
- Library/Kathleen Ferrier Court
- 731-805 High Road (odd)
- Bergen/ Brooklyn Apartments
- 809 High Road
- 813-827 High Road
- 820 High Road
- 814 High Road
- 808 High Road
- 806b High Road
- 806 High Road
- 804 High Road
- 794 High Road
- 790 High Road
- 7 White Hart Lane
- 9-39 White Hart Lane
- 8 William Street
- 1 Moselle Street
- Ermine House

17.2.28 In addition, the BRE guidelines states that schools may be considered sensitive in terms of daylight. Therefore the following schools have been included in this assessment:

- St Francais De Sales RC Primary School
- Northumberland Park Community School
- St Paul's And All Hallows Infant School

Figure 17.1 Residential and Sensitive Properties in close proximity to the site



Note: VOA stands for Valuation Office Agency (available for search)

Scenarios Assessed

17.2.29 The following scenarios have been considered and are reported within this Chapter of the ES:

- Baseline;
- The Project; and
- Cumulative scenario

Baseline

17.2.30 The Baseline scenario consists of the existing Stadium and existing surrounding buildings as can be seen today (August 2015). This scenario is depicted on drawings 9186/18-20 (Appendix 17.1).

The Project

17.2.31 The Project scenario consists of the Project in the context of the surrounding existing environment. This scenario assesses the potential daylight, sunlight, overshadowing, solar glare and light pollution effects of the Project on the surrounding residential receptors and amenity spaces as well as sensitive road junctions.

17.2.32 This scenario is illustrated on drawing no. 9186/52-53 (Appendix 17.1).

Cumulative Scenario

17.2.33 The cumulative scenario considers the Project and the surrounding cumulative schemes and compares this against the baseline. Details of the cumulative schemes considered in the assessment are presented in Chapter 2: EIA Methodology. None of the cumulative schemes are located within close proximity to the site to result in any cumulative effects for daylight, sunlight, overshadowing, light pollution and glare. Therefore a cumulative assessment has not been considered necessary.

Methodology for Determining Demolition and Construction Effects

17.2.34 Owing to the evolving and changing nature of demolition and construction activities, the assessment of potential effects during demolition and construction of the Project on daylight and sunlight to surrounding properties has not been modelled. Instead, a qualitative assessment has been undertaken using professional judgement and experience.

17.2.35 Since the potential daylight and sunlight effects relating to demolition and construction works will vary throughout the construction programme and gradually increase to the potential effects identified for the completed Project, the interim construction effects are not assessed quantitatively as it is considered that the completed Project represents the worst case assessment in terms of likely daylight, sunlight, overshadowing, solar glare and light pollution effects.

Methodology for Determining Operational Effects

17.2.36 The following approaches are undertaken to assess the effect on the sensitive receptors of surrounding properties when the Project is completed and operational:

- Daylight;
- Vertical Sky Component (VSC);
- No Sky Line (NSL) Method;
- Sunlight; and
- Annual Probable Sunlight Hours (APSH).

17.2.37 Approaches to assessing effect on amenity areas:

- Sun Hours on Ground; and
- Transient Overshadowing.

17.2.38 The effect of solar glare is also undertaken on surrounding road users and surrounding occupants of buildings, whereas Light Pollution is typically assessed on residential receptors in close proximity to the site which are considered sensitive however, consideration may also be given to upward light spill or the general brightening of the sky at night. Environmental receptors such as bats may also be considered sensitive in terms of light pollution however, these have not been identified in regards to the site and therefore are not assessed.

Outline Approach for Daylight, Sunlight and Overshadow Assessments

17.2.39 The technical analyses carried out to inform the daylight, sunlight, and overshadowing, assessment have been undertaken by creating a digital three dimensional (3D) model of the existing Site and Project, based on measured survey data.

17.2.40 The 3D model uses Waldram Diagrams to establish the VSC and 3D geometric calculations for daylight distribution. This model (which is orientated to north by the use of Ordnance Survey (OS) information) enables the path of the sun to be tracked throughout the year to establish the shadow cast by the existing and proposed buildings and thus calculate the sun hours on ground in each scenario.

17.2.41 Only those surrounding properties which have windows facing towards the Site were included in the assessment. If a nearby property has no windows facing the Site, these properties would not be affected by the Project in terms of light.

17.2.42 Where actual room layouts were available, these have been considered in regards to the modelling of the internal layouts within the surrounding properties. Where layout information was not available assumptions have been made as to the use and internal configuration of the rooms (from external observations) behind the fenestration observed. In such cases a standard 4.2 metre (m) (14ft) room depth has been assumed, unless the building form dictated otherwise. This is common practice where access to buildings for surveying is unavailable. Obtaining these room layouts enables precise evaluation of the diffuse levels of daylight within each of the rooms via the NSL).

17.2.43 Floor levels have been assumed for adjoining properties assessed, where access has not been obtained.

This dictates the level of the working plane which is relevant for the NSL assessments.

Daylight

Vertical Sky Component (VSC) Method

17.2.44 The VSC method of assessment is defined in the BRE Guidelines as the:

"ratio of that part of illuminance at a point on a given vertical plane that is received directly from a CIE standard overcast sky, to illuminate on a horizontal plane due to an unobstructed hemisphere of this sky".

17.2.45 This ratio is the percentage of the total unobstructed view that is available, once obstructions (e.g. the Project), are placed in front of the point of view.

17.2.46 The assessment is calculated from the centre of a window on the outward face and measures the amount of light available on a vertical wall or window following the introduction of visible barriers, such as buildings. The VSC has been calculated by using a 'Waldram Diagram'.

17.2.47 The Waldram Diagram is effectively a snapshot is taken from that point of the sky in front of the window, together with all relevant obstructions to it, i.e. the buildings. For calculation purposes, trees may be ignored unless they form dense continuous belts. The maximum VSC value is almost 40% for a completely unobstructed vertical wall or window. In terms of assessment criteria, the BRE Guidelines state that:

"if the VSC, with the development in place, is both less than 27% and less than 0.8 times its former value, occupants of the existing building will notice the reduction in the amount of skylight. The area lit by the window may appear more gloomy and electric lighting will be needed more of the time".

17.2.48 Where there is an extant planning permission on a site, Appendix F2 of the BRE Guide states:

"Sometimes there may be an extant planning permission for a site but the developer wants to change the design. In assessing the loss of light to existing windows nearby, a local authority may allow the vertical sky component (VSC)...for the permitted scheme to be used as alternative benchmarks. However, since the permitted scheme only exists on paper, it would be inappropriate for it to be treated in the same way as an existing building, and for the developer to set 0.8 times the values for the permitted scheme as benchmarks".

17.2.49 In regards to the Site, planning permission has historically been granted for a development on the site. The resulting levels of daylight and sunlight as well as the impacts were considered acceptable in planning terms by the local authority for this consented scheme. Therefore if the levels of retained daylight and sunlight for the Project are in line with those of the consented scheme it may be concluded that the daylight and sunlight effects will be considered acceptable. Whilst a technical assessment has not been undertaken to compare the Project against the Consented Scheme, a comparison has been made between the results for the Project and those within the ES Chapter for the Consented Scheme, where relevant, and conclusions drawn as to whether these are similar.

No Sky Line (NSL) Method

17.2.50 The BRE Guidelines provide that where room layouts are known, the effect on the daylight distribution

can be calculated by plotting the NSL. In terms of the surrounding receptors, it has not been possible to obtain room layouts for all of the properties and therefore layouts have been assumed where information is not available.

17.2.51 The NSL method is a measure of the distribution of daylight at the 'working plane' within a room. The 'working plane' means a horizontal 'desktop' plane 0.85m in height for residential properties. The NSL divides those areas of the working plane which can receive direct sky light from those which cannot. If a significant area of the working plane lies beyond the NSL (i.e. it receives no direct sky light), then the distribution of daylight in the room will be poor and supplementary electric lighting may be required.

17.2.52 The potential effects of daylighting distribution in an existing building can be found by plotting the NSL in each of the main rooms. For houses, this will include living rooms, dining rooms and kitchens. Bedrooms should also be analysed, although they are less important. The BRE Guidelines identify that if the area of a room that does receive direct sky light is reduced to less than 0.8 times its former value, then this would be noticeable to its occupants.

17.2.53 BS 8206 Part 2 states (para 5.7) that the:

"uniformity of daylight is considered to be unsatisfactory if a significant part of the working plane (normally more than 20%) lies behind the no-sky line".

17.2.54 Therefore, it is implied that an NSL of at least 80% would be considered satisfactory.

17.2.55 In regards to deep rooms which are lit by windows on one side, the BRE Guidelines state (para. 2.2.10):

"If an existing building contains rooms lit from one side only and greater than 5 m deep, then a greater movement of the no sky line may be unavoidable."

Sunlight

Annual Probable Sunlight Hours

17.2.56 Sunlight is measured using a sun indicator which contains 100 spots, each representing 1% of APSH. Therefore, where no obstruction exists the total annual probable sunlight hours would amount to 1486 and therefore each spot equates to 14.86 hours of the total annual sunlight hours.

17.2.57 The number of spots is calculated for the Baseline and Project scenarios during the year and also during the winter period, and a comparison made between the two. This provides a percentage of APSH for each of the time periods for each window assessed.

17.2.58 The BRE Guidelines note that:

- "In housing, the main requirement for sunlight is in living rooms, where it is valued at any time of day, but especially in the afternoon."
- "all main living rooms of dwellings...should be checked if they have a window facing within 90° of due south. Kitchens and bedrooms are less important, although care should be taken not to block too much sun".

- "If the main living room to a dwelling has a main window facing within 90° of due north, but a secondary window facing within 90° of due south, sunlight to the secondary window should be checked."
- "...a south facing window will, in general, receive most sunlight, while a north facing one will receive it only on a handful of occasions. East and west facing windows will receive sunlight only at certain times of day".

17.2.59 In regards to existing surrounding receptors, the BRE Guidelines provide that a window may be adversely affected if a point at the centre of the window receives for the whole year, less than 25% of the APSH, including at least 5% of the APSH during the winter months (21st September to 21st March) and less than 0.8 times its former sunlight hours during either period, and if there is a reduction in total APSH which is greater than 4%.

17.2.60 BS 8206 Part 2 (section 5.2) states that:

17.2.61 "Provided that the entry of sunlight is properly controlled, it is generally welcome in most buildings in the UK. Dissatisfaction can arise as much from the permanent exclusion of sunlight as from its excess. The provision of sunlight is important in dwellings, particularly during winter months. Sunlight is especially valued in habitable rooms used for long periods during the day."

17.2.62 "Interiors in which the occupants have a reasonable expectation of direct sunlight should receive at least 25% of probable sunlight hours (see 2.10.2). At least 5% of probable sunlight hours should be received during the winter months, between 21 September and 21 March. Sunlight is taken to enter an interior when it reaches one or more window reference points."

17.2.63 As is often the case, it is not possible to determine the room uses within each of the neighbouring properties, nor is it clear which window should be considered as the 'main windows'. Therefore, regardless of use, all the rooms with windows facing the Site and within 90 degrees of due south have been considered in the assessment.

17.2.64 Where there is an extant planning permission on a site, Appendix F2 of the BRE Guide states:

"Sometimes there may be an extant planning permission for a site but the developer wants to change the design. In assessing the loss of light to existing windows nearby, a local authority may allow the...annual probable sunlight hours (APSH) for the permitted scheme to be used as alternative benchmarks. However, since the permitted scheme only exists on paper, it would be inappropriate for it to be treated in the same way as an existing building, and for the developer to set 0.8 times the values for the permitted scheme as benchmarks".

Summary of Criteria for Daylight and Sunlight

17.2.65 The following table provides a summary of the criteria set out within the BRE Guidelines for daylight and sunlight.

Table 17.1 Summary of Daylight and Sunlight Assessment Criteria

17.2.68 VSC	17.2.69 A window may be adversely affected if its VSC measured at the centre of the window is less than 27% and less than 0.8 times its former value.
17.2.70 NSL	17.2.71 A room may be adversely affected if the daylight distribution (NSL) is reduced beyond 0.8 times its existing area.
17.2.72 APSH	17.2.73 A window may be adversely affected if a point at the centre of the window received for the whole year, less than 25% of the APSH including at least 5% of the APSH during the winter months (21st September to 21st March) and less than 0.8 times its former sunlight hours during either period, and for existing neighbouring buildings, if there is a reduction in total APSH which is greater than 4%.

Sun Hours on Ground

- 17.2.74 The method for assessing hours in sun is the 'Sun-on-Ground indicator'. The assessment applies to both to new and existing gardens / amenity areas, which are affected by new developments. The 2011 BRE Guidelines suggest that the Spring Equinox (21st March) is a suitable date for the assessment. Using specialist software, the path of the sun is tracked to determine where the sun would reach the ground and where it would not.
- 17.2.75 The BRE Guidelines recommend that at least half of a garden or amenity area should receive at least 2 hours of sunlight on March 21st or the area which receives 2 hours of direct sunlight should not be reduced to less than 0.8 times its former value (i.e. there should be no more than a 20% reduction). This assessment, therefore, reviews the percentage of an amenity area which receives 2 hours of direct sunlight (identified in yellow in the figures within *ES Volume 3 (Appendix 17.3)*).

Transient Overshadowing

- 17.2.76 The 2011 BRE Guidelines suggests that where large buildings are proposed which may affect a number of gardens or open spaces, it is useful to plot a shadow plan to illustrate the location of shadows at different times of the day and year. For the purpose of this assessment the overshadowing was mapped for the following three key dates in the year:
- 21st March (Spring Equinox);
 - 21st June (Summer Solstice); and
 - 21st December (Winter Solstice).
- 17.2.77 September 21st (Autumn Equinox) provides the same overshadowing images as March 21st (Spring Equinox) as the sun follows the same path at these corresponding times of year.
- 17.2.78 For each of these dates, the overshadowing is calculated at hourly intervals throughout the day from 08:00 to 19:00. Some images are not included within *Appendix 17.3* because the sun would not be present during these times (e.g. from approximately 16:00 onwards on 21st December) and thus no shadow can be cast.

- 17.2.79 The indicators are calculated for different latitudes, London being at 51.5° north. Southern orientation is critically important, as are the heights of the existing and proposed buildings.

Light Pollution

- 17.2.80 Light pollution is defined as any light emitting from artificial sources into spaces where it is unwanted, such as spillage of light from office or commercial buildings onto streets, or, into residential accommodation, such as bedrooms where this would cause nuisance to the occupants. The ILP Guidance Notes provide measurable lighting level values to ascertain the acceptability of lighting levels at night.
- 17.2.81 It should be noted that light pollution is not always perceived as being negative, particularly in areas of high crime where good street lighting and light into street environments is seen as a positive attribute. Adverse effects caused as a result of electric lighting include the intrusion of light into sensitive locations including adjacent residential accommodation; areas of special night-time interest; or needless spillage into the night sky.
- 17.2.82 It should also be noted that the ILP Guidance relates to external luminaires. Commercial buildings with large areas of glazing can sometimes cause light intrusion from their internal luminaires which may affect nearby sensitive receptors and quantitative light pollution assessments have been undertaken in relation to these internal luminaires.
- 17.2.83 Potential light pollution effects of a new development are typically assessed in relation to four specific criteria:
- Sky Glow is the brightening of the night sky over our towns, cities and countryside. It can be quantified by measuring the Upward Light Ratio (ULR), which is the maximum permitted percentage (%) of luminaire flux for the total installation that goes directly into the sky;
 - Light Intrusion is the spilling of light beyond the boundary of a proposed development. It is assessed as vertical illuminance in lux (Ev) measured flat at the centre of the sensitive receptor;
 - Luminaire Intensity is the uncomfortable brightness of a light source when viewed against a dark background. It is applied to each source visible from a sensitive receptor and is measured as source intensity (I) (kcd); and
 - Building Luminance which can cause an increase in the brightness of a general area and is measured in cd per metre squared (L) as an average over the building facade caused only by external lighting.
- 17.2.84 The Project includes sports lighting within the Stadium and a variety of external light fittings across the Site. GIA have been supplied details of the various lighting designs and the proposed locations of these with indications of potential lux levels. Given that the majority of these fittings are located some distance from the neighbouring/proposed residential receptors and that they have been designed in accordance with the ILP and sports lighting guidance, a detailed technical assessment has not been undertaken but a qualitative assessment has been undertaken based on the methodology below.

Light Intrusion Methodology

- 17.2.85 Light pollution is not a comparative assessment; the fact it may occur in the baseline does not justify its

occurrence as a result of the Project. Therefore the assessment considers the effect of the Project in absolute terms, by reference to the relevant guidance levels.

- 17.2.86 The qualitative assessment considers the location of each of the light fittings in relation to the surrounding residential receptors (existing and proposed). Based on the details of the lighting design conclusions have been drawn into whether these will result in any instances of light pollution according to the four criteria above and the likelihood for these to result in light pollution and a potential nuisance using the ILP guidance. The table below from the ILP provides the recommended levels based on the environmental location of the site which in this case comes under Zone 4.

Table 17.2 ILP Light Pollution Criteria for Environmental Zones

Environmental Zone	Sky Glow ULR (Max %) (1)	Light Intrusion (into windows) Ev (Lux) (2)		Luminaire Intensity (candelas) (3)		Building Luminance Pre-curfew (4)
		Pre-curfew	Post-curfew	Pre-curfew	Post-curfew	Average L[cu/m2]
E0 – Dark areas (e.g. UNESCO Starlight Reserves, IDA Dark Sky Parks)	0	0	0	0	0	0
E1- Intrinsically dark areas (e.g. National Parks, areas of outstanding natural beauty)	0	2	0 (1*)	2,500	0	0
E2- Low district brightness (e.g. rural or small village locations)	2.5	5	1	7,500	500	5
E3- Medium district brightness (e.g. small town centres or urban locations)	5.0	10	2	10,000	1,000	10
E4- High district brightness (e.g. town/city centres with high levels of night time activity)	15.0	25	5	25,000	2,500	25

Notes:

ULR = Upward Light Ratio of the Installation is the maximum permitted percentage of luminaire flux for the total installation that goes directly into the sky

Ev = Vertical Illuminance in Lux and is measure flat on the glazing at the centre of the window

I = Light Intensity in Cd

L = Luminance in Cd/m2

Curfew = The time after which stricter requirements (for the control of obtrusive light) will apply; often a condition of use of lighting applied by the planning authority. If not otherwise stated – 23.00 hrs is suggested.

* = From Public road lighting installations only.

Solar Glare

17.2.87 Solar glare is particularly important at pedestrian and road junctions, where glare can cause temporary blinding of drivers or pedestrians. Typically those elements considered reflective are either glazed apertures or metal cladding.

17.2.88 The 2011 BRE Guidelines includes the following statement in regards to the potential for reflected solar glare from a new development:

17.2.89 “Glare or solar dazzle can occur when sunlight is reflected from a glazed façade. This can affect road users outside and the occupants of adjoining buildings. The problem can occur either when there are large areas of reflective glass or cladding on the façade, or when there are areas of glass or cladding which slope back so that high altitude sunlight can be reflected along the ground. Thus solar dazzle is only a long term problem only for some heavily glazed (or mirror clad) buildings...”

Viewpoints for Road Users and Pedestrians

17.2.90 As indicated previously, the assessment considers potentially sensitive viewpoints for road users and pedestrians surrounding the Site. The viewpoints are generally located at the minimum stopping distance

and at the driver's eye level. The focal point is a relevant traffic element, such as signals or incoming traffic.

- 17.2.91 Identifying the viewpoints based on the stopping distance is calculated as the combination of thinking and breaking distances, using the following formula:

$$D_{total} = D_{thinking} + D_{breaking} = V \cdot T + \frac{V^2}{2\mu \cdot g}$$

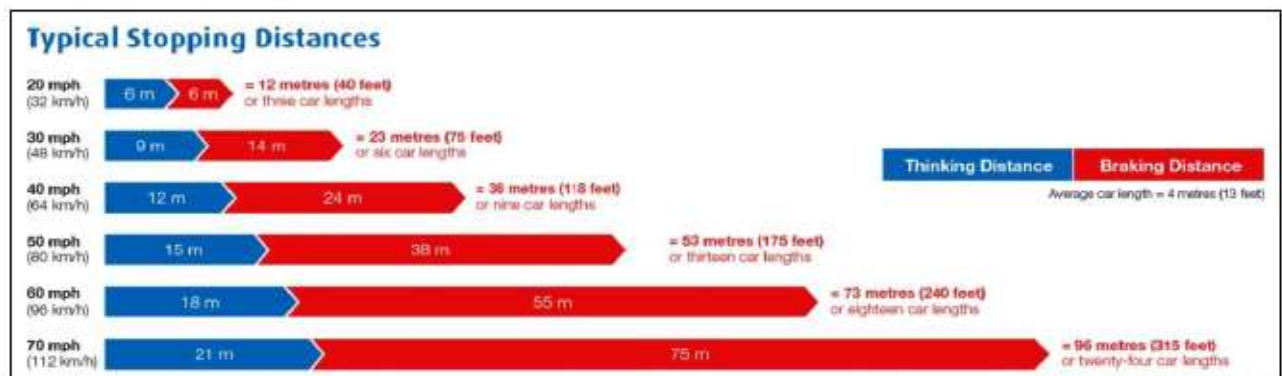
- 17.2.92 where each component is:

- V = Relevant vehicle speed, typically the road speed limit;
- T = Thinking time (0.67 sec);
- μ = Breaking effort (considered 0.65 for cars and 0.5 for buses); and
- g = Gravity acceleration.

- 17.2.93 The height of the viewpoint is considered to be 1.5m for cars and 2.0m for buses. Figure 17.2 below identifies the typical stopping distance range for a car travelling at different speeds. Therefore, a viewpoint for a car driving at 30mph (i.e. speed limit for a dense urban location) would be placed at 23m from a traffic light and 1.5m above the ground.

- 17.2.94 The assessment also considers a driver's/pedestrian's field of vision which takes the angular extent seen at any given time, which for humans facing forwards is approximately 180 degrees.

Figure 17.2 Typical Stopping Distances for a car



Solar Glare Technical Assessment

- 17.2.95 The potential for reflected solar glare or dazzle from the glazed or reflective façades from a development have been assessed using specialist lighting software. The assessment shows the path of the sun for the entire year around the Project. From this, two computer generated angular images have been produced for each selected viewpoint, indicating the area which sees the reflection of the sunpath at any point during the year. A modified diagram portraying a standardised extent of human vision is then overlaid onto the image.
- 17.2.96 The assessment has been undertaken on the basis that the fovea centralis (also generally known as the fovea) is a part of the eye, located in the center of the macula region of the retina. The fovea is

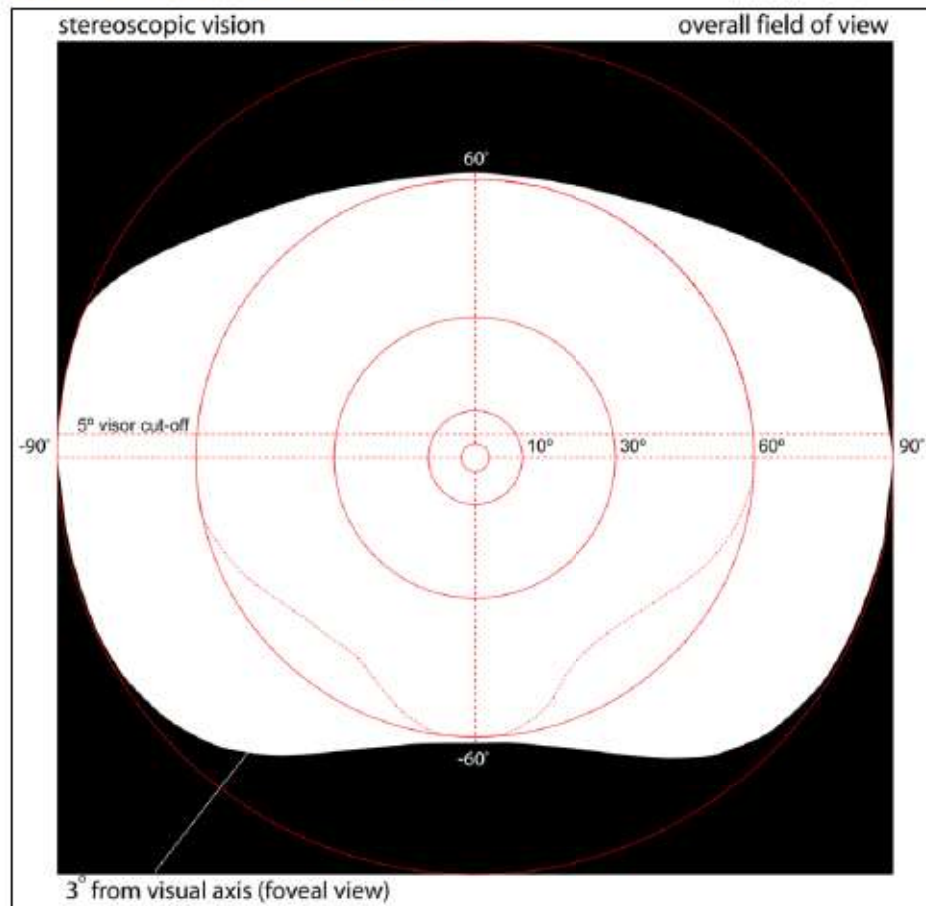
responsible for sharp central vision (also called foveal vision), which is necessary in humans for reading, watching television, driving, and any activity where visual detail is of primary importance⁶⁵. The macula corresponds to the central 13 degrees of the visual field; the fovea to the central 3 degrees⁶⁶.

- 17.2.97 Figure 17.3 below highlights the degrees of vision corresponding to the foveal view, with a red circle of 3° of angle in order to identify the area most sensitive to reflected solar glare. Another red circle represents the incidence of the 30° radius of our typical field of view in order to identify a secondary area of sensitivity to potential reflected glare instances.

⁶⁵ "Simple Anatomy of the Retina". Webvision. University of Utah, <http://webvision.med.utah.edu/book/part-i-foundations/simple-anatomy-of-the-retina/>

⁶⁶ (Robert H. Spector (1990). Clinical Methods: The History, Physical, and Laboratory Examinations, 3rd edition, Chapter 3 - www.ncbi.nlm.nih.gov/books/NBK220/)

Figure 17.3 Field of Vision Diagram



- 17.2.98 The degrees of vision provide a reference from which potential concerns can be judged. At 3°, the potential for the reflected glare to cause a hazard is high and mitigation would be required. Between 3° and 30°, there is the potential that there could be an issue and mitigation may be necessary.
- 17.2.99 As stated in the CIE 146:2002, occurrences at angles beyond 30° would be of little significance in most situations, but may be relevant in exceptional circumstances. When seated in a driving seat of a typical car, for example, the limits of the windscreen would generally obstruct the driver's view at angles beyond 30° from the line of sight. Therefore the risk of reflective solar glare causing a hazard is reduced and, as such, mitigation would make only a minor difference.
- 17.2.100 The methodology for solar glare is not aimed at addressing the intensity of an instance of reflected solar glare, but rather its occurrence, duration throughout the year, and the location of this occurrence in respect of an individual's line of sight. It is also noted that the hours presented reflect solar time and therefore do not take Daylight Saving Hours into account.
- 17.2.101 Although great care is taken in identifying typical viewpoints, this does not guarantee that there are no additional sensitive locations where reflected solar glare could present a particular risk. This assessment is based on the assumption that in an urban environment moving traffic represents the biggest risk factor and so viewpoints and focus points are selected accordingly. For practical reasons the area of the assessment is limited to the area surrounding the Project. The occurrence of reflected solar glare at

greater distances is not the subject of this assessment.

Significance Criteria

Effect Significance Terminology Overview

17.2.102 The assessment of effect significance outlined within the below sections is consistent with the terminology and criteria outlined within Chapter 2: EIA Methodology of this ES and accords with the relevant standards and guidance. The terminology used to describe the sensitivity of resources / receptors and magnitude of the effect will be as follows:

- High;
- Medium;
- Low; and
- Very Low.

17.2.103 The key terminology to be used to describe the classification of effects is as follows and is further described in the below sections of this chapter:

- Major;
- Moderate;
- Minor; and
- Negligible.

17.2.104 The nature of the effects may be either adverse (negative) or beneficial (positive).

17.2.105 Following the classification of an effect using this methodology, a clear statement is then made as to whether the effect is significant or not significant. As a general rule, the following criteria is applied:

- 'Moderate' or 'major' effects are deemed to be 'significant';
- 'Minor' effects are considered to be 'not significant', although they may be a matter of local concern; and
- 'Negligible' effects are considered to be 'not significant' and not a matter of local concern.

17.2.106 Evaluating Effects and Significance – Daylight, Sunlight, Overshadowing, Solar Glare and Light Pollution

Daylight and Sunlight

17.2.107 For daylight and sunlight, the BRE Guidelines outline the approach within the accompanying appendix, in terms of assigning criteria to assess the effects:

"Adverse impacts occur when there is a significant decrease in the amount of skylight and sunlight reaching an existing building where it is required, or in the amount of sunlight reaching an open space... The assessment of impact will depend on a combination of factors, and there is no simple rule of thumb that can be applied."

"Where the loss of skylight or sunlight fully meets the guidelines, the impact is assessed as negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate. Where the loss of light is only just within the guidelines and a larger number of windows or open space are affected, a minor adverse impact would be more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space."

17.2.108 "Where the loss of skylight or sunlight does not meet the guidelines in this book, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:

- Only a small number of windows or limited area of open space are affected;
- The loss of light is only marginally outside the guidelines;
- An affected room has other sources of skylight or sunlight; and
- The affected building or open space only has a low level of requirement for skylight or sunlight.

17.2.109 The classification of major adverse is documented within Paragraph 7 of the BRE Guidelines:

"Factors tending towards a major adverse impact include:

- *a large number of windows or large area of open space are affected;*
- *the loss of light is substantially outside the guidelines;*
- *all the windows in a particular property are affected; and*
- *the affected indoor or outdoor spaces have a particular strong requirement for skylight or sunlight, eg. a living room in a dwelling or a children's playground".*

17.2.110 Where the BRE Guidelines are met, the effects will be considered negligible.

17.2.111 With regard to the BRE Guidelines, professional judgement has been used to determine whether the potential effects will result in adverse or beneficial effects. The initial numerical criteria for determining the category of effect is based on percentage alterations, as follows:

- 20-29.9% alteration = minor;
- 30-39.9% alteration = moderate; and
- 40% alteration = major.

17.2.112 However, when assigning criteria per property, consideration has been given to the proportion of

rooms/windows affected, as well as the percentage alterations, absolute changes, and any other relevant factors, such as there may be mitigating factors such as balconies, overhangs or design features which may also affect the determination of assigning the criteria.

Sun Hours on Ground

17.2.113 The table below sets out the numerical criteria adopted in regards to the sun on ground assessment based on professional judgement.

Table 17.3 Sun on ground Significance Criteria

Significance	Numerical criteria on 21 March
Negligible	Over 50% of the amenity area will receive 2 hours of sunlight or less than 20% alteration in area which receives 2 hours of direct sunlight. .
Minor adverse	20-29.9% reduction in the area which receives 2 hours of direct sunlight.
Moderate adverse	30-39.9% reduction in the area which receives 2 hours of direct sunlight
Major adverse	40%+ reduction in the area which receives 2 hours of direct sunlight

Transient Overshadowing

17.2.114 The BRE Guidelines do not include criteria for the significance of transitory overshadowing other than to identify the different times of the day and year when shadow would be cast over a surrounding area.

17.2.115 The assessment of potential effects as a result of transient overshadowing is therefore based on professional judgement, taking into consideration the conditions of the existing Site and surrounding area, and comparing these conditions against the effect of the transient overshadowing arising from the Project.

Light Pollution

17.2.116 The ILP Guidance Notes do not provide any details with regard to the assigning of significance criteria for light pollution, therefore this is based on professional judgement considering the extent of the façade adversely affected as well as the extent to which the thresholds set out in the guidance are exceeded. As a qualitative assessment has been undertaken, the focus is on the potential likelihood for light intrusion to occur and be a nuisance to an occupant.

Solar Glare

17.2.117 There are no quantitative criteria within the BRE Guidelines or elsewhere regarding acceptable levels of solar glare experienced at a viewpoint. Professional judgement has therefore been applied to assign the degree of effect from the effect of solar glare arising from the Project and to determine the criteria for assessing the significance of solar glare set out in Table 17.3 below.

17.2.118 Generally, solar glare reflected at steeper angles is less likely to cause nuisance or distraction as one has to look upwards to see it.

17.2.119 As discussed at each of the locations identified, multiple viewpoints may be chosen for each of the traffic lanes or signals affected. However, in terms of significance criteria professional judgement has been used

to determine the effect at the location rather than the individual perspectives at a signal traffic junction/pedestrian crossing.

Table 17.4 Criteria used for Determining the Effect of Solar Glare

Significance	Description
Negligible	No reflections are visible or if visible all occur at angles greater than 30° from the driver's line of sight and so, as stated by the CIE, will be of "little significance"
Minor	Solar reflections are visible within 30° to 10° or between 10° to 5° of the driver's line of sight for a short period of time
Moderate	Solar reflections are visible within 10° and 5° of the driver's line of sight occurring for a long period of time.
Major	Solar reflections are visible within 5° of a driver's line of sight.

Note – mitigating factors such as alternative and unaffected signals/traffic lights and car visor angle may result in the assignment of significance which differs from the above numerical guidelines.

17.3 Inherent Design Mitigation

- 17.3.1 Throughout the design of the Project consideration has been given to the levels of daylight, sunlight and overshadowing to the surrounding receptors and amenity spaces.
- 17.3.2 A programme of iterative daylight and sunlight testing has assisted with the design process. A number of preliminary massing options for the north podium building and southern elements have been tested to measure the effects on neighbouring residential properties. In addition, preliminary transient overshadowing studies were undertaken to measure the effects on neighbouring residential amenity spaces, which in turn have assisted with the positioning of the southern elements.
- 17.3.3 A programme of iterative daylight assessments have also been undertaken with regard to the evolving design of the southern residential element. VSC façade studies showing the daylight potential to the new residential blocks are included within Appendix 17.5 and discussed in more detail within this ES Chapter.

Limitations to the Assessment

- 17.3.4 A qualitative assessment has been undertaken for Light Pollution based on the lighting design information supplied and professional opinion as to the probability of any light spill issues.
- 17.3.5 Due to the outline nature of the residential blocks these have been considered as massing only and therefore the assessments do not consider any potential reflectivity or light spill into these units, given that the window locations are not fixed.

17.4 Baseline Conditions

Daylight and Sunlight

- 17.4.1 Full details of the baseline assessment are located within Appendix 17.2. A total of 1589 windows serving 917 rooms within 147 properties have been assessed for daylight and 508 windows within 84 properties for sunlight. Whilst the assessment has been undertaken for all of the surrounding residential properties and schools identified in Figure 17.1 the discussion within this ES chapter focuses on the effects to those sensitive receptors identified earlier in paragraph 17.2.28 within this chapter.

- 17.4.2 With regard to the existing levels of daylight and sunlight for the surrounding receptors, Table 17.5 in *Appendix 17.2* provides an indication of the baseline (existing) results for those properties which are considered to be sensitive in terms of daylight and sunlight. With regards to the APSH assessment, those properties that have a total of 0 windows assessed are north facing and therefore not applicable to the assessment.
- 17.4.3 Out of the 1589 windows assessed, 1056 (66%) have a baseline VSC equal to or greater than 27% whereas 766 (84%) out of the 917 rooms assessed have a daylight distribution to at least 80% of the total room area. With regard to sunlight out of the 594 windows assessed, 674 (88%) meet the BRE guidelines for sunlight in the baseline.
- 17.4.4 These relatively high levels of compliance reflect the relatively low levels of massing and obstruction currently on the site. This is not typical for an urban location such as that of the site and given the mayoral and LBH aspirations for the area it would be unreasonable to expect these levels to stay the same.

Sun Hours on Ground

- 17.4.5 Full details of the baseline sun hours on ground assessment can be found in *Appendix 17.3* and summarised below.
- 17.4.6 In the baseline scenario all of the external amenity areas assessed will meet the BRE criteria in regards to the sun hours on ground assessment. All receive at least 2 hours of direct sunlight to at least 80% of the total area compared to the 50% required by the BRE guidelines.
- 17.4.7 Again these results reflect the relatively low levels of obstruction in the surrounding context and on the site.

Transient Overshadowing

- 17.4.8 The results of the existing baseline transient overshadowing assessment are shown in *Appendix 17.3*. Given the relatively modest height and massing of the existing buildings on Site, there is little overshadowing of the general amenity spaces and surrounding area in the baseline condition on 21st March, 21st June and 21st December.
- 17.4.9 Overshadowing is evident, at 17:00 GMT on the 21st March with the existing development casting shadow over the playground of St Paul's and All Hallows Infant and Junior School and the outdoor playing fields of Northumberland Park sports centre both to the east of the site. However, as this is late in the day the school playground will not be in use at this time. A small amount of shadow is also cast on the private garden of one of the residential properties on Worcester Avenue between 09:00 and 12:00 GMT. A slightly smaller amount of shadow is also cast on the school and sport centre grounds on June 21st at 20:00 GMT.
- 17.4.10 On 21st December, overshadowing occurs on the grounds of Northumberland Park Sports centre and Northumberland Park Community School at 15:00 GMT. A small amount of shadow is also cast on the private gardens of several of the residential properties on Worcester Avenue closest to the site between 09:00 and 11:00 GMT.

17.5 Potential Environmental Impacts and Effects

Demolition and Construction

Demolition

- 17.5.1 The potential significant effects of demolition of the existing buildings and structures on the Site would lead to a temporary improvement in daylight, sunlight, and overshadowing effects to residential properties and open spaces located close to the Site.
- 17.5.2 Portable external lighting apparatus would likely be used during the demolition phase which may result in minor instances of light pollution. However, it is likely such units would be in use during working hours only and the effects would therefore be temporary (i.e. they would only last as long as the portable lighting units are in use).
- 17.5.3 The likely significant daylight, sunlight and overshadowing effects during the demolition phase would be **temporary** and of **minor beneficial** significance. The effect in terms of light pollution would be of **temporary** and of **insignificant to minor adverse** significance.

Construction

- 17.5.4 The construction of new buildings / massing on the Site would have a gradual effect on the levels of daylight, sunlight and overshadowing on the surrounding receptors as the massing of the proposed buildings increases over time. Therefore, the effects in terms of daylight, sunlight and overshadowing would increase incrementally as the construction progresses and would be no worse than the completed Project.
- 17.5.5 In regards to solar glare, likely significant effects would only occur as the glazing and metal cladding is installed and therefore, would be no worse than the completed Project. Potential **temporary minor adverse** effects may occur in terms of light pollution with the use of portable lighting units during the construction phase. However, it is likely that these would only be used during working hours.

Operation

Daylight effects to surrounding properties

- 17.5.6 Full details of the daylight assessments can be found in *Appendix 17.2*.
- 17.5.7 Out of the total 1589 windows assessed 954 (60%) meet the BRE criteria for VSC whereas 696 (76%) of the 917 rooms assessed meet the criteria for NSL.
- 17.5.8 All of the windows within those properties highlighted green on the Table 17.6 in *Appendix 17.2* would meet the BRE guidelines for VSC and NSL.
- 17.5.9 The results in Table 17.6 in *Appendix 17.2* and the discussion below focus on those properties close to the Site and which are considered to be sensitive in terms of daylight.

St Francais De Sales RC Primary School

- 17.5.10 There are 54 windows within this property serving 22 rooms.
- 17.5.11 In regards to VSC, 37 (69%) out of the 54 windows will meet the BRE guidelines and therefore the effect on these windows is considered to be **negligible**.
- 17.5.12 All of the 17 windows that do not meet the BRE guidelines will experience alterations between 20-30% which is considered to be relatively **minor adverse** in significance. 13 of these windows retain a VSC of 26-26.5% which is fractionally below the BRE recommended 27% and therefore may be considered acceptable given the surrounding context of the site.
- 17.5.13 The remaining four windows retain an absolute VSC of 15% to 22% which could also be commensurate with a dense urban environment.
- 17.5.14 As this property is a school, there is a possibility that several of these windows serve circulation space or ancillary rooms rather than classrooms and other principle rooms which may not be considered sensitive in terms of daylight.
- 17.5.15 In regards to NSL, 14 (64%) out of the 22 rooms assessed will meet the BRE guidelines and thus experience a **negligible** effect.
- 17.5.16 Out of the remaining eight rooms, five rooms experience alterations between 20-30%, two rooms experience alterations between 30-40% and one room experiences alterations beyond 40%. These effects are likely result of the proximity of the school to the Site combined with the undeveloped nature of the site creating open and unobstructed views. In addition, it is likely that some of the affected rooms have ancillary uses to the school such as offices or circulation space rather than classrooms and therefore may not be considered as sensitive in terms of daylight.
- 17.5.17 Overall given the non-residential use of this property, the effect is considered to be **minor adverse** in significance.

729 High Road

- 17.5.18 There are 26 windows within this residential property serving 12 rooms.
- 17.5.19 In regards to VSC, 9 (35%) out of the 26 windows will meet the BRE guidelines and therefore the effect on these windows is considered to be negligible.
- 17.5.20 Of the remaining 17 windows, four will experience alterations between 20-30% which is considered to be minor adverse in significance. Also, two of these windows will retain VSC levels above 24.5% which is just below the recommended 27% in the BRE guidelines.
- 17.5.21 Nine windows will experience alterations between 30-40%, however one of these windows serves a bedroom and is therefore considered less sensitive in daylight terms compared to other uses such as living rooms. The remainder of these windows have proposed VSC levels between 15% and 21% which may be considered commensurate with the surrounding context of an urban location.
- 17.5.22 A total of four will experience alterations of over 40%. However, of these four windows, one has an existing level of VSC of 4.5% which is considered low (compared to the recommended 27%) whereby any

alteration could result in a disproportionate percentage change triggering a transgression of the BRE. A second window out of the four will retain a VSC level of 17% which could be considered commensurate within the surrounding context of an urban environment.

- 17.5.23 In regards to NSL, nine (75%) out of the 12 rooms assessed will meet the BRE guidelines and thus experience a negligible effect.
- 17.5.24 Of the three remaining rooms, two will experience an alteration between 20-30% and one will experience alterations between 30-40%. However, the latter is understood to be a bedroom which by reference to the BRE is considered less sensitive in terms of daylight compared to a living room.
- 17.5.25 Overall given the residential use of this property and the retained levels of daylight, the effect is considered to be **minor to moderate adverse** in significance.

4-18 Brereton Road

- 17.5.26 There are 40 windows within this property serving 40 rooms.
- 17.5.27 In regards to VSC, 33 (83%) out of the 40 windows will meet the BRE guidelines and therefore the effect on these windows is considered to be negligible.
- 17.5.28 For the remaining seven windows, three will experience alterations between 20-30% which is considered minor adverse in significance. Four windows will experience alterations between 30-40%. However, these windows have low existing levels of VSC (all under 13%) whereby any alteration may result in a disproportionate percentage change, which is further shown by the small absolute alterations that are all below 4.5%.
- 17.5.29 In regards to NSL, 32 (80%) out of the 40 rooms assessed will meet the BRE guidelines and thus experience a negligible effect.
- 17.5.30 Of the remaining eight rooms, six will experience alterations between 20-30% and two will experience alterations between 30-40%. However, room uses are not known within this property and therefore there is a possibility that several may be bedrooms, bathrooms or circulation space which need not be considered.
- 17.5.31 Overall given the residential use of this property, the effect is considered to be **minor adverse** in significance.

Library – Kathleen Ferrier Court

- 17.5.32 There are 79 windows within this property serving 32 rooms.
- 17.5.33 In regards to VSC, 20 (25%) out of the 79 windows will meet the BRE guidelines and therefore the effect on these windows is considered to be negligible.
- 17.5.34 Out of the remaining 59 windows, seven windows will experience between 20-30% alterations which is considered minor adverse in significance and eight windows will experience 30-40% alterations.

- 17.5.35 A total of 44 windows will experience alterations above 40%. Of these, four windows will experience alterations over 78%, however the room uses are unknown for this property and there is a possibility that several of the rooms may be bathrooms or circulation space which are not relevant for the assessment. Other may be bedrooms which are less sensitive in terms of daylight than other room uses such as living rooms as stated within BRE guidelines.
- 17.5.36 12 of the windows experiencing in excess of 60% alterations are on the ground floor and therefore serve the library and are not considered as sensitive to residential rooms such as living rooms.
- 17.5.37 The existing unobscured view from this building is reflected in the high existing VSC levels shown, however, it is unreasonable to expect such levels to be maintained given the aspiration to regenerate the area.
- 17.5.38 In regards to NSL, 16 (50%) out of the 32 rooms assessed will meet the BRE guidelines and thus experience a negligible effect.
- 17.5.39 For the remaining 16 rooms, two will experience alterations between 20-30% and nine will experience between 30-40% alterations. Therefore five rooms will experience alterations of over 40%, however as the room uses are not known for this property there is a chance that these room are less sensitive spaces such as bedrooms.
- 17.5.40 Overall given the retained levels of daylight the effect on Library – Kathleen Ferrier Court is considered to be **moderate adverse** in significance.
- 731-741 High Road*
- 17.5.41 There are 28 windows within this terrace of mixed use properties serving 27 residential rooms.
- 17.5.42 In regards to VSC, two (7%) of the 28 windows will meet the BRE guidelines and therefore the effect on these windows is considered to be negligible.
- 17.5.43 The remaining 26 windows will all experience over 40% alterations in VSC level. All 26 windows will retain VSC levels above 17.5% and therefore may be considered commensurate with the surrounding context of a dense urban environment of which the Site is located within. In addition, the room uses are unknown and there is a possibility that several of the windows assessed may be bedrooms which are considered less sensitive than living areas as stated within BRE guidelines. There is also possibility that the windows serve bathrooms or circulation space which are not considered relevant within this assessment.
- 17.5.44 In regards to NSL, none of the 27 rooms assessed will meet the BRE guidelines experiencing in excess of 40% alterations. However, the room uses for these properties are unknown and there is a possibility that these rooms are bedrooms which by reference to the BRE are considered less sensitive in terms of daylight compared to living rooms. There is also possibility that these rooms are bathrooms or circulation space which are not considered relevant within this assessment.
- 17.5.45 These properties appear to have an existing unobscured view which is reflected in the existing high VSC levels. In the baseline condition the windows within these properties generally receive levels of VSC at around 35%, which represents a broadly unobstructed view of sky. Given the aspiration to regenerate the Tottenham area it is unreasonable to expect such levels to be maintained.

- 17.5.46 The extant planning permissions previously granted for the Project Site saw these windows typically reduced to between 20-23% retained VSC. The latest proposals do not lead to a material deviation outside of this range.
- 17.5.47 Overall the effect on 731-741 High Road is considered to be **moderate to major adverse** in significance.
- 743-759 High Road*
- 17.5.48 There are 47 windows within this terrace of mixed use properties serving 38 residential rooms.
- 17.5.49 In regards to VSC, two (4%) of the 47 windows will meet the BRE guidelines and therefore the effect on these windows is considered to be negligible.
- 17.5.50 Of the remaining 45 windows, two windows within 759 High Road will experience between 30-40% alterations and the remaining 43 windows will all experience over 40% alterations in VSC level. All of the 45 windows that do not meet the BRE guidelines (27%) will retain VSC levels of 16% and above which may be considered commensurate with a dense urban environment. It must also be noted that room uses are unknown and there is a possibility that several of the windows assessed serve bedrooms which are considered less sensitive than living areas as stated within BRE guidelines. There is also possibility that the windows serve bathrooms or circulation space which are not considered relevant within this assessment.
- 17.5.51 Two of the windows that will experience over 40% alterations in VSC are both within property 745 and are understood to serve bedrooms which by reference to the BRE are considered less sensitive in terms of daylight compared to living rooms.
- 17.5.52 In regards to NSL, none of the 38 rooms assessed will meet the BRE guidelines with four of the remaining rooms experiencing alterations between 30-40% and 34 rooms experiencing in excess of 40% alterations. Four of the rooms will retain between 59.64-64.76% NSL levels which may be considered commensurate with the dense urban environment.
- 17.5.53 It is understood that one of these rooms is a bedroom within 745 High Road, therefore as stated within the BRE Guidelines is less sensitive to daylight than living rooms. However, the uses for the remaining rooms within these properties are unknown and there is a possibility that these rooms are which by reference to the BRE are considered less sensitive in terms of daylight compared to living rooms. There is also possibility that these rooms are bathrooms or circulation space which are not considered relevant within this assessment.
- 17.5.54 These properties appear to have an existing unobscured view which is reflected in the existing high VSC levels. In the baseline condition the windows within these properties generally receive levels of VSC at around 35%, which represents a broadly unobstructed view of sky. Given the aspiration to regenerate the Tottenham area it is unreasonable to expect such levels to be maintained.
- 17.5.55 The extant planning permissions previously granted for the Project site saw these windows typically reduced to between 19-23% retained VSC. The latest proposals do not lead to a material deviation outside of this range.
- 17.5.56 Overall the effect on 743-759 High Road is considered to be **major adverse** in significance.